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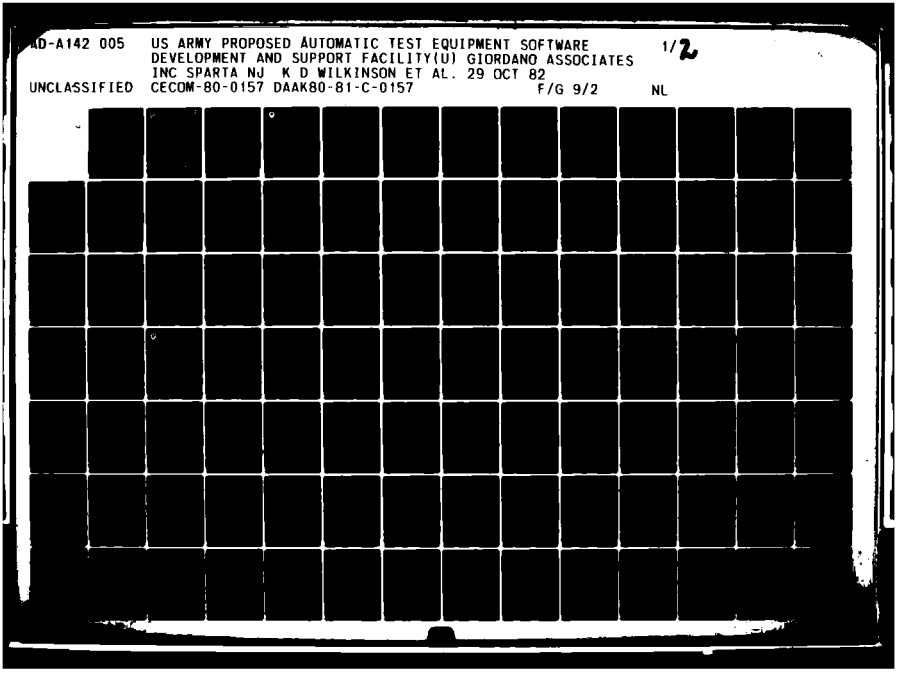

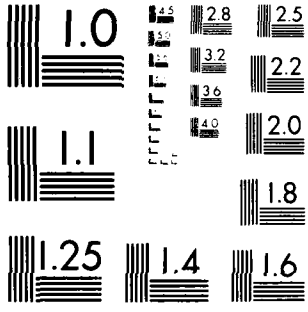

RESEARCH AND DEVELOPMENT TECHNICAL REPORT

CECOM-80-0157

US ARMY PROPOSED AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

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October 1982

Final Report for period September 1981 to October 1982

approved for public Release: distribution unlimited

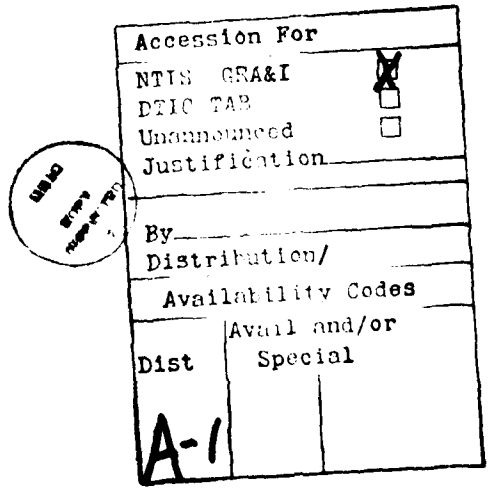
Prepared for

Program Manager
Test, Measurement and Diagnostic Equipment
ATTN: DRCPM-TMDE-L
Fort Monmouth, N.J. 07703

US ARMY
PROPOSED AUTOMATIC TEST EQUIPMENT
SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

The description of the Facility, or more accurately, Library, is contained in four documents. The documents have been bound together into this single book to aid the reviewer.

Section 1	IMPLEMENTATION PLAN
Section 2	CONCEPT PLAN
Section 3	FUNCTIONAL REQUIREMENTS DOCUMENT
Section 4	PRELIMINARY DESIGN SPECIFICATION



RESEARCH AND DEVELOPMENT TECHNICAL REPORT

CECOM-80-0157 III

US ARMY PROPOSED AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY IMPLEMENTATION PLAN

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US ARMY PROPOSED AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

IMPLEMENTATION PLAN

CONTENTS

Executive Summary

In view of the Army's rapidly increasing use of high technology electronics in prime and support systems as well as constantly shrinking manpower and skill levels, Automatic Test Equipment (ATE) is now a mandatory element in maintenance concepts and strategies. Control of costs related to the utilization of ATE is of major concern as is the effectiveness of the maintenance plan. Reducing the proliferation of ATE within the Army is being addressed; however, the most significant cost driver in ATE systems is ATE software - specifically Test Program Sets (TPS's).

This document recommends the implementation of a Pilot ATE Software Development and Support Facility for the Army. Such a facility will provide the mechanism needed to establish controls over the TPS life cycle as well as systematize the processes associated with TPS acquisition, development and post-deployment support. The objective is to field performance-effective and supportable TPS's at minimum life cycle costs.

Standardization to the extent that is possible and economically beneficial is necessary throughout the TPS life cycle. Simplification of the acquisition process is also required. The Facility discussed within this document will be the vehicle for many technical innovations and mechanisms which will provide a dramatic savings in the life cycle costs of TPS's and ATE software in general. In addition, through these same mechanisms the performance effectiveness of TPS's will be significantly increased producing a positive effect on prime system operational readiness.

The implementation of the Software Support Facility has been structured in such a way as to blend in with the current Development and Readiness Command (DARCOM) planning for Test Program Set (TPS) development, support, and control while still remaining flexible enough to adapt during the period of evolution. TPS's are the major cost driver for Automatic Testing life cycle cost. With proper planning and use of appropriate standard documentation, programming tools, and programming aids it will be possible for the Army to field higher quality TPS that have been more thoroughly debugged during development as well as becoming easier and less costly to update.

The keys to the success of the Army Software Support Facility for ATE have been defined in three previous documents: the Concept Plan, number CECOM 80-0157-F, dated Sep 82, the

Functional Requirements Document, number DAAK 80-81-C-0157-II, dated 5 Sep 82, and the Preliminary Design Specification, number DAAK 80-81-C-0157-IV, dated Apr 82. These documents define the various standards, tools, and aids that should be available in the Facility for Army-wide use. The concept for the Facility was selected on the basis of many studies and plans developed by the Army, Air Force, and Navy and partially implemented in the Navy. To eliminbate the expensive and time-consuming process of "reinventing the wheel" the various standard documents, programming tools, and aids were selected from existing, under development or planned development programs and projects whenever possible. Many of the projects under development and planned are identified in the Joint Logistics Commanders Subtask Description; these specific tasks have been identified in the Functional Requirements Document. Some of the various standard documents, programming tools, and aids are currently in use by the Army or other Services. These have been clearly identified to allow the rapid implementation of the Facility at an affordable cost.

The DARCOM Test Program Set policy as well as identification of specific implementation organizations is currently undergoing changes; therefore, it was not possible to use the final guidance. Nevertheless, the most current drafts of the policy, as well as the Department of the Army Test, Measurement and Diagnostic Equipment Action Team (DATAT) report and the Army Post Deployment Software Support (PDSS) Concept Plan (including major Command messages on PDSS plans) have been reviewed and used in the development of the Implementation Plan. Due to the current evolution of organizational issues this Plan has remained as generic as possible regarding organization. It is necessary for the overall Facility to be under the control of a single DARCOM agency to assure that the various standard documents, programming tools, and aids are developed and applied. The single DARCOM control agency will be a part of the overall Test, Measurement and Diagnostic Equipment (TMDE) centralized management structure established by the commanding general of DARCOM acting as the Army TMDE executive agent. The actual implementing organizations, however, can be spread across the Development and Readiness commands as required by DARCOM. With the rapid communication that is available throughout the United States by computer links, voice, and air delivery it will even be possible to have the functions completed at various geographic locations if the evolving DARCOM organization requires this.

At this time it appears that most of the standard documentation such as regulations, acquisition guides, model statements of work, etc., as well as cost prediction models will be most efficiently operated by Development agencies. The actual

programming tools such as automatic test program generators and composition terminals can be operated by Readiness Command activities. Many of the other tools and aids such as configuration status accounting can be operated by either or both commands. The exact selection of location will depend on the workload, physical facilities, and existing or projected manpower. Further details are included in later pages of this work.

By structuring the Facility as indicated in the preceding paragraphs it will be possible to develop and operate the Facilities with only limited additional manpower within the commands. There will need to be some reallocation of personnel who are currently completing similar or possible duplicative efforts in various programs. If these people are also involved in additional functions it may not be possible to transition them completely to the Facilities; therefore, new personnel assignments will be required. This is especially true during the initial establishment and operation of the Facility as extensive training on the use of the various standards, tools, and aids and communication links must be provided. The initial training cadre will require 2 to 3 people for approximately 1 to 1 1/2 years. Many of the tools and aids are being developed by several agencies as part of prime system contracts; therefore, with centralized direction it will be possible for one program/product management office to consolidate requirements from others, partially eliminating duplicative efforts and reducing cost. This effort should require 2 to 3 people located in a development agency. The actual operation of the Facility will require 12 to 15 people.

As of now most of the TPS cost is buried in the various prime system total costs and is not highly visible but as the multitude of TPS are delivered to the Army and organic support is attempted the cost will become very apparent as various programming aids and tools must be procurred, operated, and maintained by Army personnel. Reduction of this proliferation will not only reduce acquisition costs but will reduce future logistics costs for the various tools and aids. The library of standards, documents, tools and aids contained in the Facility will provide guidance for improved acquisition of TPS and also provide means to verify the quality of the TPS. This will make it possible for higher quality TPS's to be delivered to the field through better documentation and more complete debugging before delivery. This early debugging not only improves the potential for increasing the effectiveness and efficiency of testing, but it also reduces the cost of reworking TPS after fielding.

To aid in projecting budget requirements for the various items that will be contained in the Facility a section containing the Rough Order of Magnitude cost has been included for items that require some development. The cost estimates have been derived from many sources, including the JLC Automatic Testing Subtask Description, similar tasks completed by the joint Services, and extrapolation from existing programs. In all cases the total cost to complete the development efforts has been included, and quite often this figure gives the appearance of a cost that is higher than what the Army must pay. This is because the Air Force and Navy are currently scheduled to fund all or part of the development work as defined in the JLC Plan. Also substantially more money than this will be spent by the various prime system program offices on similar or possibly duplicative tasks. The actual cost is difficult to obtain as it is buried so far down in the work breakdown structure of the prime system cost. The total figures were included to show the additional cost the Army will need to absorb if the other Services do not complete the projects as required.

The overall impact of implementing the Facility and making all the identified standard documents, programming tools, and programming aids available will be to deliver high-quality and supportable TPS to the field and to adequately maintain the TPS at an affordable cost. The result of inaction will be the continued proliferation of various tools and aids with their duplicative cost as well as the difficulty of maintaining and improving the TPS after delivery. The quantity and rate of TPS's entering the Army inventory is increasing rapidly; therefore, the longer it takes to provide to Army program offices and contractors the various standards, tools, and aids contained in the Facility, the opportunity to improve TPS effectiveness and to control cost will be missed on many programs.

1.0 INTRODUCTION

1.1 Purpose

The purpose of this study report is to establish a viable baseline plan for the design of the U.S. Army proposed ATE Software Development and Support Facilities. These facilities will be utilized to effect controls over the Test Program Set (TPS) life cycle, provide dramatic cost savings over the TPS life cycle, and significantly increase the effectiveness of deployed Automatic Test Equipment (ATE) systems.

Maintenance requirements are rapidly changing and management must plan to meet these critical needs. Planning efforts must address the total spectrum of needs. New or revised policy and procedures must be promulgated to institutionalize the ne maintenance strategies. These maintenance strategies mus address emerging technology and consider operational needs.

Planning to support the ATE Software Development and Suppoı Facilities included the development of several plans. A Concep Plan sets forth the notion of these Facilities and documents the need for their relative functional capabilities. The concept will also illustrate how these Facilities fit into the general operational scheme of prime system and support system acquisition. A Functional Requirements Document formally establishes the functions of the ATE Software Development and Support Facility and provides a basis for the mutual understanding between users and designers regarding the definition of this Facility. In addition, a Design Specification defines the required equipment and resources including hardware, and software, and personnel needed to complement the concept. This Implementation Plan provides a generic description of the organization needed to implement the U.S. Army Proposed Automatic Test Equipment Software and Development Facility that can be tailored to match the Development and Readiness Command (DARCOM) TPS policy and organization. The report also places the recommended projects into categories of technology and development with a further breakout of short term and long term. To aid in budget planning, a Rough Order of Magnitude cost estimate has also been included.

1.2 Approach

There are several objectives for this study effort. They are as follows:

a. Validate the need for an ATE Software Development and Support Facility
b. Establish a dialogue with Army activities involved in the TPS life cycle
c. Determine the impact of emerging systems on current methods of maintenance
d. Assess the technology required to support such a concept
e. Evaluate alternative approaches and examine other military solutions

In order to satisfy these objectives, the study team visited several Army organizations which are cognizant over some process within the TPS life cycle. The study team also visited Army contractor facilities as well as Air Force and Navy organizations. Further, the study team evaluated a variety of reports concerning the issues related to TPS life cycle management. Among these reports are:

a. Joint Logistics Commanders (JLC) Panel on Automatic testing
b. U.S. Air Force Mate Guides
c Industry/Joint Services Report on Automatic Testing
d. Naval Sea Systems Command (NAVSEA)/Naval Electronic Systems Command (NAVELEX) ATE/TPS Coordination Center Program Reports
e. Various DARCOM plans and policy letters for Post Deployment Software Support (see Concept Plan, appendix C)
f. Army Test Program Set (TPS) Management Plan, draft 15 July 82
g. Department of the Army Test Measurement and Diagnostic Equipment Action Team (DATAT) Final Report, April 82

1.3 Results

This study has confirmed that due to changing maintenance requirements, current assets must be upgraded. To accurately assess the true maintenance needs a Workload Analysis (WLA) must be performed to adequately scope hardware, facilities, capital plant equipment and personnel needs. The WLA needs to be

performed on a continuing basis to ensure and justify an adequate support-oriented asset base. Further, management support for maintenance technology needs to be centralized to maintain pace with the rapidly changing technological requirements.

A dialogue has been established with a variety of Army activities involved in electronic maintenance. This dialogue has been fruitful. All visits and meetings have resulted in the acceptance of the ATE Software Development and Support Facility concept. These activities have also identified the need for more efficient tools concerning TPS development and maintenance. Among the items identified as essential are the establishment of a corporate memory of prior TPS development efforts, through standard documents, directives and trained personnel, as well as providing the means to maintain and track the configuration of the developing and deployed TPS's with an automated Configuration Status Accounting System (CSAS).

2.0 ORGANIZATION/LOCATION

The U.S. Army proposed ATE Software Development and Support Facility has been defined in the Concept Plan, Functional Description Document, and Preliminary Design Specification with this Implementation Plan defining how the Facility may be structured. The commanding general of the Development and Readiness Command (DARCOM) has been designated as the U.S. Army executive agent for Test, Measurement and Diagnostic Equipment. In this role he has established a centralized management structure to develop and support all TMDE. The centralized development of TMDE has been concentrated within the Office of the Program Manager, Test, Measurement and Diagnostic Equipment. This program management office will provide the centralized direction necessary to develop and acquire the various standard documents, programming tools and aids that will be included in the Facility. The actual operation of the Facility will be conducted by other Development and Readiness activities.

Headquarters DARCOM established a Test Program Set (TPS) Management Plan Task Force in early 1982 to define these roles. To assure early dissemination of the information contained in this Plan and to permit a framework for development of the various identified products the TMDE Program Management Office has elected to release this Plan prior to completion of the TPS Task Force deliberations. The various Facility documents have been structured to be compatible with the new TPS policy and organization responsibilities that will be defined by the task force.

The Facility will provide access to all the standard documents, programming tools, and aids for all Users (government and government contractors); however, the actual application of the products will be provided by the using personnel. The Facility can be considered as a library that provides its products through communication links to various organizations. Application of this concept will allow the maximum use of the various products, thereby reducing the need for each organization to develop costly duplicative products. Centralized location(s) for the Facility will also reduce the manpower needs. The Naval Electronics Engineering Center's operation of a centralized automatic test program generation facility has demonstrated the facility concept on a limited scale.

With the easy availability of rapid communication links through computers, telephone, and airlift it will even be possible to split the Facility into different geographic locations if required by DARCOM. The most obvious products to split are the programming aids that require extensive communication time; therefore, some of the equipment could be located on the east coast while the remainder is located on the west coast.

3.0 IMPLEMENTATION PROJECTS AND ROM COST ESTIMATES

The U.S. Army proposed ATE Software Development and Support Facility Concept Plan in conjunction with the Functional Requirements Document provides a description of the various standard documentation, programming aids and programming tools that should be included in the Facility. The preliminary Design Specification defines how the hardware, software, and documents are to be installed in one or more Facilities as well as how the communication network connects the Users with the Library. These three documents should be consulted for details that are not contained in this Implementation Plan.

To obtain payoff from the Facility it is not necessary for all of the contents to be in place; therefore, to begin receiving the maximum payoff from the Facility, work can be done incrementally by establishing a prototype Facility by first collecting all of the existing identified documents, tools, and aids immediately. These items will then be available to all the Users at an early date. Concurrent with this effort the work can begin on development of the new technology items as well as continuing or starting full scale development and modification on the remaining products.

The following three subsections (3.1, 3.2, and 3.3) break the products into the various categories for clarity.

3.1 Existing Items,

Many of the library contents identified in the Concept Plan paragraph 2.2 are currently available in the Army, Air Force, or Navy and should be made available immediately through the Facility to all Army Users. By starting immediately with these products it will be possible to incrementally build up the contents of the Library while developing the necessary communication links, operating procedures, and training courses. As discussed earlier, the organization that provides centralized control of the Facility as well as the implementing organizations will be directed by the DARCOM Commander as the U.S. Army Executive Agent for TMDE.

In some cases more than one version of the various TPS documentation, aids, and tools exists within the Services and should be collected for inclusion in the Library. It may be desirable to include two or more versions in the Library until the preferred version(s) can be identified through use or command

decision. As these products already exist the cost to include multiple versions will be minimal.

The following subparagraphs define where the products may be obtained as well as referencing the appropriate Concept Plan paragraph numbers where additional details may be obtained.

3.1.1 Standard Documentation

(a) Test Requirement Document (TRD) Standard (Concept Plan paragraph 2.2.1 (d) - A new MIL Std 1519B has been reviewed by the JLC Automatic Testing Panel and is now receiving formal joint service review. The Draft document should be provided at this time bor information as it will aid in obtaining better and more maintainable TPS.

(b) ATLAS Standards (Concept Plan paragraph 2.2(h)) - The hardbound copies of the Institute of Electrical and Electronics Engineers (IEEE) Standards should be placed in the Library. Copies may be obtained from the U.S. Navy Document Center in Philadelphia or by direct purchase from the IEEE. Since DOD has adopted Common ATLAS as the standard for use on DOD programs, IEEE Std 716 Common ATLAS and IEEE Std 717 Common ATLAS Formal Syntax should be obtained immediately and various Facility Users should be notified of the procedures to obtain individual copies. The Naval Air Engineering Center, Lakehurst NAS, NJ, is working with IEEE to provide the Common ATLAS on a computer disc to all Users.

(c) Other Languages (Concept Plan paragraph 2.2(i)) - Due to its widespread use the documentation, as well as training courses, for EQUATE ATLAS should be included in the Library.

(d) TPS Configuration Management Plan (Concept Plan paragraph 2.2 (j)) - Tobyhanna Army Depot has developed a model TPS Configuration Management Plan that is currently available. The Air Force MATE Program Office, ASD/AEGB, Wright-Patterson AFB, OH, 45433, also has developed a CM Plan that will meet Army needs with minimum tailoring.

3.1.2 Programming Aids

(a) CAD for [illegible] (Concept Plan paragraph 2.3 (i)) - Many Computer Aid Desig[illegible] software packages are available. The Army should obtain [illegible] of them that are currently being used by prime system con[illegible]s and paid for by the Army.

(b) Word Processor (Concept Plan paragraph 2.3 (t)) - Numerous word processors are being used in the Army. The Facility should obtain one that will permit transfer of data to various Users. The Facility should be able to transfer data to different media and different formats to enhance the distribution of documents. The Navy and Air Force (Lakehurst NAS, NJ, Wright Patterson AFB, Oh. and Kelly AFB, TX) are successfully using small commercial microprocessor systems.

3.1.3 Programming Tools

(a) Digital ATPG (Concept Plan paragraph 2.4 (a)) - Several Automatic Test Program Generators (ATPG's) are currently being used by Tobyhanna and Sacramento Army Depots. These systems can be tied into the Facility communication network for interim use on a time share basis. Additional ATPG capability will have to be placed in the Facility as soon as possible. The new equipment will be used in the development programs rather than purchasing new ones for each prime system program or contractor. The additional ATPG time will also be qvailable for maintaing the deployed TPS's. It may be possible to arrange some time sharing with the Naval Air Engineering Center ATPG Facility both to share their services initially and in turn provide them future expansion.

(b) Digital Simulator (Concept Plan paragraph 2.4 (b)) - The same comments as listed for the ATPG's apply to the simulators.

(c) Text Editor (Concept Plan paragraph 2.4 (e)) - Numerous Text Editors are being used by the Army and their contractors. Standardized versions should be selected and placed in the Facility.

(d) RCA EQUATE ATLAS Compiler and Syntax Checker(Concept Plan paragraph 2.4(g)) - Appropriate versions of the EQUATE Compiler and Syntax Checker and documentation used on the AN/USM-410 should be included.

(e) Other Compilers and Syntax Checkers (Concept Plan paragraph 2.4 (h)) - Compilers and syntax checkers used on ATE by more than one Army program and which will be used in the future should be included in the Facility. Examples of the ATE are the Genrad 2225, STE/ICE, etc.

(f) EQUATE TPS Generation Station (Concept Plan paragraph 2.4 (o)) - The TPS generation station developed by Tobyhanna Army Depot should be provided to other Users through the Facility Communication Network.

3.2 Technology Projects

Items listed in this section of the report are the various programming aids and programming tools that will require some technology work before they are transistioned to full scale development. Under the current DARCOM organization it is anticipated that the Army Test Measurement and Diagnostic Technology Laboratory (ATTL) will provide the centralized direction for these projects. In reality, the actual completion of the projects may be carried out by various Army organizations as reflected in the Army Test, Measurement and Diagnostic Technology team. To further aid in planning the projects they are divided into two categories: rapid payoff technology (less than two years to transition to development) and longer term technology (more than two years to transistion to development). The following subparagraphs list the various projects as well as identifying the Concept Plan paragraph number where additional information may be obtained on the project. If the project is also covered by the Joint Logistics Comammanders (JLC) Automatic Testing Plan, the Air Force Modular Automatic Test Equipment (MATE) Program, or the Navy Consolidated Support System (CSS) Program it also will be noted.

The following section contains some Rough Order of Magnitude (ROM) cost estimates for the various technology projects that have been identified. The ROM cost estimate has been arrived at by comparing similiar programs and also from estimates contained in the JLC Automatic Testing Plan Subtask description. In many cases some of this cost has already been allocated by other services; therefore, the cost to the Army will be reduced. To assure duplicative tasks are not completed by the services it is important that tasks identified as JLC or those that are listed as MATE, CSS or ongoing Army be closely coordinated by the apporopriate Army Program/Project Management Office. The close coordination will help the Army Program/Project Management Office obtain the various products earlier and cheaper than "going-it-alone". The other services may be able to assist in funding projects that the Army establishes under the JLC Automatic Testing Plan.

3.2.1 Rapid Payoff Technology Projects

3.2.1.1 Programming Aids

(a) TPS Quality Assurance Tools (Concept Plan paragraph 2.3 (l))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	180	220	60	44	48	552

(b) Graphics Development Aids (Concept Plan paragraph 2.3 (j))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	40	30	26	30	32	158

3.2.1.2 Programming Tools

(a) ATLAS Flow Chart Generator (Concept Plan paragraph 2.4 (d))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	100	200				300

(b) ATLAS Composing Terminal (Concept Plan paragraph 2.4 (k))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	700	1500	1000			3200

3.2.2 Longer Term Payoff Technology Projects

3.2.3.1 Programming Aids

(a) Graphics Development Aids (Concept Plan paragraph 2.3 (j))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	160	120	104	120	128	632

(b) TPS Fault Isolation Models (Concept Plan paragraph 2.3 (k))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	220	250	350	290	250	1360

3.2.3.2 Programming Tools

(a) Analog ATPG (Concept Plan paragraph 2.4 (c) and JLC Automatic Testing Plan 30508)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	150	700	1580	1300	900	4630

(b) Self Improving ATE/TPS (Concept Plan paragraph 2.4 (l) and JLC Automatic Testing Plan 30508)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	200	1200	4000	700	400	6500

(c) Failure Modes Effects Analysis (FMEA) to ATLAS Translator (Concept Plan paragraph 2.4 (j))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	100	230	390	290	320	1330

3.3 Development Projects

Items listed in this section of the report are the various programming aids, programming tools and standard documentation that will require some development work before they are implemented. Under the current DARCOM organization it is anticipated that the Product Manager Automatic Test Support System (PM, ATSS) will provide the centralized direction for these projects. In reality, the actual completion of the projects may be carried out by various Army program/product management offices. To further aid in planning the projects they are divided into two categories: rapid payoff development (less than 2 two years to completion) and longer term payoff development (over two years to completion). The following subparagraphs list the various projects as well as identify the Concept Plan paragraph number where additional information may be obtained on the project. If the project is also covered by the

Joint Logistics Comammanders (JLC) Automatic Testing Plan, the Air Force Modular Automatic Test Equipment (MATE) Program, or the Navy Consolidated Support System (CSS) Program it also will be noted.

The following section contains some Rough Order of Magnitude (ROM) cost estimates for the various development projects that have been identified. The ROM cost estimate has been derived by comparing similar programs and also from estimates contained in the JLC Automatic Testing Plan Subtask description. In many cases some of this cost has already been allocated by other services; therefore, the cost to the Army will be reduced. To assure duplicative tasks are not completed by the services it is important that tasks identified as JLC or those that are listed as MATE, CSS or ongoing Army be closely coordinated by the appropriate Army Program/Project Management Office. The close coordination will help the Army obtain the various products earlier and cheaper than "going-it-alone." The other services may be able to assist in funding projects that the Army establishes under the JLC Automatic Testing Plan.

3.3.1 Rapid Payoff Development

3.3.1.1 Programming Aids

(a) TPS LCC Prediction Model (Concept Plan paragraph 2.3 (a), JLC Automatic Testing Plan 20402, 30101, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	30					30

(b) TPS Development Cost Models (Concept Plan paragraph 2.3 (b), JLC Automatic Testing Plan 30101, CECOM, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	40					40

(c) TPS Schedule and Cost Tracking System (Concept Plan paragraph 2.3 (c), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	40					40

(d) TPS Acquisition Data Collection System (Concept Plan paragraph 2.3 (f), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	60	30				90

3.3.1.2 Programming Tools

(a) IEEEE Std 716 Common ATLAS Compiler and Syntax Checker (Concept Plan paragraph 2.4 (f), JLC Automatic Testing Plan 30111, CECOM, NAEC, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	450	50				500

(b) Test Program Development Stations (Concept Plan paragraph 2.4 (m))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	1000	800				1800

3.3.1.3 Standard Documentation

(a) Facility Users Guide and Training Courses (Concept Plan paragraph 2.2 (a))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	65	50				115

(b) TPS Acquisition Guide (Concept Plan paragraph 2.2 (b), JLC Automatic Testing Plan 20503, 20504, 20801, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	75	10				85

(c) Design for Testability Guide (Concept Plan paragraph 2.2 (c), JLC Automatic Testing Plan 20302, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	300	100				400

(d) Model UUT Test Requirement Document (TRD) Statement of Work (SOW) (Concept Plan paragraph 2.2 (e), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	30					30

(e) Model TPS SOW (Concept Plan paragraph 2.2 (f), JLC Automatic Testing Plan 10201, 10202, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	20					20

(f) Model TPS Specification (Concept Plan paragraph 2.2 (g), JLC Automatic Testing Plan 20304 and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	70	20				90

(g) Model TPS Integrated Logistics Support (ILS) Plan (Concept Plan paragraph 2.2 (k), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	20					20

(h) Model TPS Quality Assurance Plan (Concept Plan paragraph 2.2 (l), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	20					20

(i) Model TPS Request for Proposal (RFP) (Concept Plan paragraph 2.2 (m), and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	30					30

(j) TPS Style Guide (Concept Plan paragraph 2.2 (n), JLC Automatic Testing Plan 20501, and Tobyhanna)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	30					30

3.3.2 Longer Term Payoff Development Projects

3.3.2.1 Programming Aids

(a) UUT Failure Data Collection System (Concept Plan paragraph 2.3 (d), MATE, and CSS)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	70	40				110

(b) ATE/TPS Operations Data Collection System (Concept Plan paragraph 2.3 (e), MATE, and CSS)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	70	40				110

(c) Library of ATLAS Procedures (Concept Plan paragraph 2.3 (g))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	85	20				105

(d) Unit Under Test (UUT) vs ATE and Interface Test Adapter (ITA) Matching Algorithm (Concept Plan paragraph 2.3 (h), JLC Automatic Testing Plan 20601, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	110	85	45			240

(e) TPS Quality Assurance (Concept Plan paragraph 2.3 (l), JLC Automatic Testing Plan 30110, and MATE)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	720	880	240	176	192	2208

(f) Workload Analysis System (Concept Plan paragraph 2.3 (m))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	140	80	30			250

(g) ATE/TPS Operation Model (Concept Plan paragraph 2.3 (n))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	110	50				160

(h) Depot and General Support (GS) ATE Shop Scheduling System (Concept Plan paragraph 2.3 (o), and CSS)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	120	50				170

(i) TPS Developer Configuration Status Accouting System (CSAS) (Concept Plan paragraph 2.3 (p), MATE, and CSS)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	150	80				230

(j) Army TPS Managers CSAS (Concept Plan paragraph 2.3 (q), Tobyhanna Army Depot, MATE, and CSS)

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	150	80				230

(k) Shop Testing Capabilities System (Concept Plan paragraph 2.3 (r))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	190	150	50			390

(l) Deficiency Reporting and Feedback System (Concept Plan paragraph 2.3 (s))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	90	45				135

3.3.2.2 Programming Tools

(a) Translators (Concept Plan paragraph 2.4 (i))

FISCAL YEAR	84	85	86	87	88	TOTAL
$ in 1000's	500	300				800

4.0 CONCLUSIONS AND RECOMMENDATIONS

In order to upgrade the ability of the Army to meet the maintenance challenges presented to them via the new wave of high-technology weapons and support systems, it is essential to effect standardization on the TPS life cycle process. This process needs to be formally defined and controlled. The acquisition of ATE software is full of contracting traps which work against the government. Procedures for TPS contracting, including Statements of Work specification preparation must be simplified to a routine level and facilitated by automation. Management information systems are needed to guide the TPS acquisition process, create an audit trail, and develop a corporate memory to provide lessons learned for future acquisitions.

There are many software tools and aids which are now used to simplify and automate the TPS acquisition, development, and maintenance process; however, in order to preserve the positive effect these tools promise, they must be benchmarked and receive formal approval and entry into the Army standard family of TPS tools and aids. Such a standard family must be controlled so that changes or enhancements do not destroy the traceability required to facilitate TPS maintenance.

As maintenance strategies push sophisticated ATE systems closer to the front lines a means for providing consistent technical support to these forward detachments is essential. Technicians will require a single source for assistance relative to their commodity. This will ensure the effectiveness of the ATE while stabilizing the morale of the technician.

It is recommended that a pilot Army ATE Software Development and Support Facility be developed to meet the requirements set forth in this document and the Concept Plan, Functional Requirements Document and Preliminary Design Specification. Such a facility could serve as a pilot for implementation of specific ATE software policy and guidance. Other facilities will emerge to support increasing operational requirements. All facilities should be networked to ensure backup support in case of malfunction, etc. The pilot Facility shall be the test bed for new standard documents, software tools, and programming aids and will validate these products in order to accept them as part of the Army ATE software asset base. The pilot Facility will also provide facilities to back up all data bases on line at other similar facilities.

This program should commence immediately by developing a communciation network using existing assets that are in place or that are being procurred. The Facility or Library can be available within 90 days using existing items identified in section 3.1, as well as tailoring the items outlined in section 3.2 and 3.3.

APPENDIX A

Outline of the Naval Sea Systems Command (NAVSEA)/Naval Electronics Systems Command (NAVELEX) Automatic Test Equipment (ATE)/Test Program Set (TPS) Coordination Center

A brief outline of the Navy TPS Coordination Center being developed by the Fleet Analysis Center is provided as general information on a similar concept that is being developed to support small digital testers.

Additional information may be obtained from:

Mr. Jim Hoote
Fleet Analysis Center
Code 824
Corona, CA 91720
AV 933-4469

NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER
FUNCTIONAL REQUIREMENTS

- SUPPORT USER CONFIGURATION IDENTIFICATION AND STATUS ACCOUNTING
- SUPPORT THE MAINTENANCE AND UPDATE OF ATE HARDWARE/SOFTWARE AND DOCUMENTATION
- PROVIDE AND MAINTAIN A FAMILY OF TEST PROGRAMMING AIDS
- PROVIDE AND MAINTAIN FACILITATING DATA BASES
- PROVIDE AND MAINTAIN A FAMILY OF TEST PROGRAM TRANSLATORS
- PROVIDE TECHNICAL INTERFACE TO NEW PROGRAMS
- ACT AS A FOCAL POINT FOR USER ATE/TPS PROBLEMS

NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER

- o PROVIDES TOOLS FOR TPS
  - oo DEVELOPMENT
  - oo MAINTENANCE
  - oo MANAGEMENT
- o ADDRESSES FORWARD MAINTENANCE STRATEGY
- o SUPPORTS DIGITAL TESTING FOR
  - oo GR 2225
  - oo THREE PHOENIX
- o USED BY TPS DEVELOPERS LOCATED IN
  - oo DEPOTS
  - oo OTHER GOVERNMENT FACILITIES
  - oo CONTRACTORS

NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER

- PROVIDES TOOLS FOR TPS
  - DEVELOPMENT
  - MAINTENANCE
  - MANAGEMENT
- ADDRESSES FORWARD MAINTENANCE STRATEGY
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- USED BY TPS DEVELOPERS LOCATED IN
  - DEPOTS
  - OTHER GOVERNMENT FACILITIES
  - CONTRACTORS

COORDINATION CENTER CONCEPTUAL MODEL

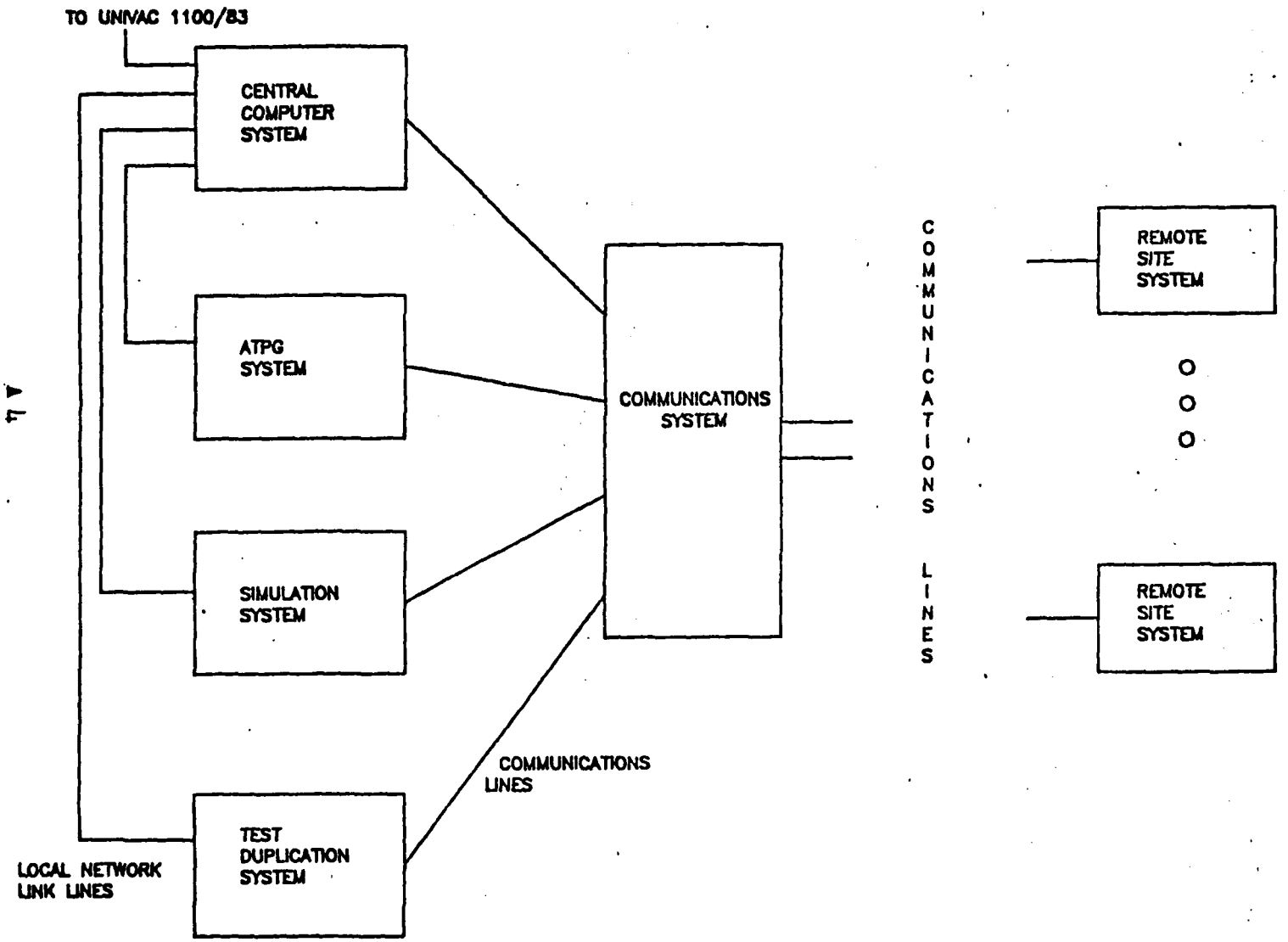

FIGURE 2-1

NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER

- MAJOR BENEFITS - TPS DEVELOPMENT AND MAINTENANCE
  - IMPROVED TECHNICIAN SUPPORT OF TESTING PROBLEMS
  - STANDARDIZED TPS & ASSOCIATED DOCUMENT STORAGE AND RETRIEVE SYSTEM
  - STANDARDIZED TPS QUALITY ASSURANCE DUPLICATE
  - CORPORATE MEMORY TO SUPPORT TPS DEVELOPERS
  - COMPLETE AND ACCURATE TRAINING PROGRAM FOR TPS DEVELOPMENT
  - STANDARDIZED TPS QUALITY ASSURANCE
  - LOWER COST FOR DEVELOPMENT AND OPERATION: OVER $34,000,000 OVER 7 YEARS AGAINST UNPLANNED SUPPORT

NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER

- MAJOR BENEFITS - TPS DEVELOPMENT AND MAINTENANCE
  - IMPROVED TECHNICIAN SUPPORT OF TESTING PROBLEMS
  - STANDARDIZED TPS & ASSOCIATED DOCUMENT STORAGE AND RETRIEVE SYSTEM
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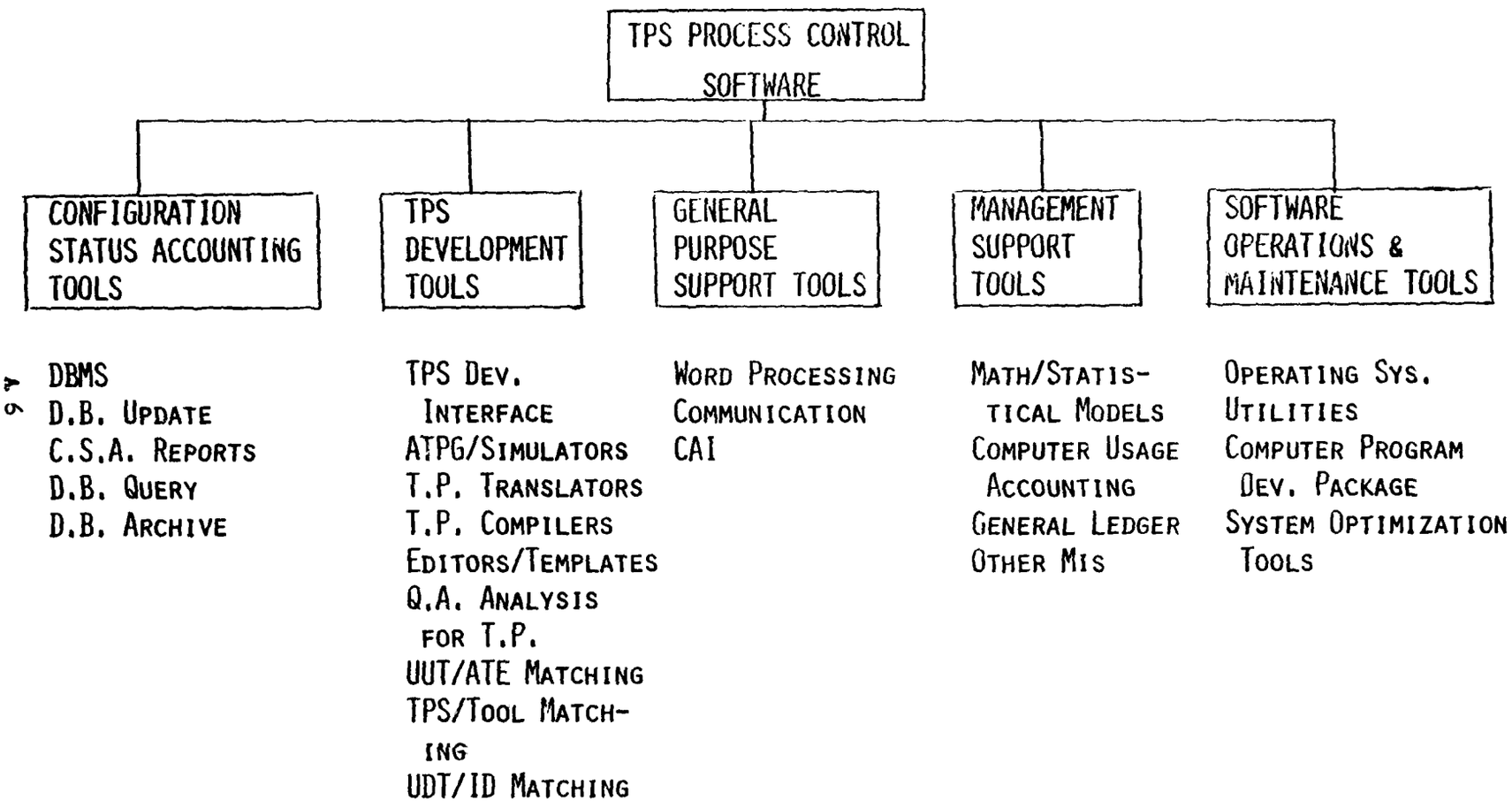
  - LOWER COST FOR DEVELOPMENT AND OPERATION: OVER $34,000,000 OVER 7 YEARS AGAINST UNPLANNED SUPPORT

NAVSEA/NAVELEX ATE/TIPS COORDINATION CENTER

SOFTWARE ALTERNATIVES



NAVSEA/NAVELEX ATE/TPS COORDINATION CENTER

AUTOMATED INFORMATION SYSTEM MILESTONES

	SCHEDULED	STATUS
SYSTEM DEFINITION (MILESTONE 0)	JUL 80	APPROVED
CONCEPT DEVELOPMENT (MILESTONE 1)	APR 81	APPROVED
DEFINITION DESIGN (MILESTONE 2)	NOV 81	BEING REVIEWED
PILOT IMPLEMENTATION	NOV 82	
SYSTEM DEVELOPMENT (MILESTONE 3)		

APPENDIX B

Outline of the MATE TPS Acquisition Guide

A brief outline of the content of the MATE Test Program Set (TPS) Acquisition Guide is provided to indicate some work that is in process or planned that will provide many TPS acquisition documents, programming tools and aids. Many of these products may be easily tailored for Army use, permitting the ATE Software Development and Support Facility to be established and effective sooner at a lower cost.

Additional information may be obtained from:

Lt Col Gene Jensen
ASD/AEGB
Wright-Patterson AFB, OH 45433
AV 785-6612

TEST PROGRAM SET ACQUISITION GUIDE

- THREE VOLUMES
  - EXECUTIVE SUMMARY (VOL I)
  - PROCEDURES (VOL II)
  - TOOLS (VOL III)

VOL II, TPS ACQUISITION PROCEDURES

- PROGRAM MANAGEMENT - LIFE CYCLE FLOW CHARTS AND TASK PROCEDURES TO PERMIT A SYSTEMATIC IMPLEMENTATION OF GUIDE
- PROGRAM CONTROL - PROCEDURES TO TRACK COST, SCHEDULE, PERFORMANCE AND SUPPORTABILITY
- ENGINEERING - PROCEDURES TO ADDRESS KEY PERFORMANCE AND QUALITY ASSURANCE ISSUES
- CONFIGURATION MANAGEMENT - PROCEDURES COVERING CONFIGURATION IDENTIFICATION, CONTROL, AND ACCOUNTING
- DATA MANAGEMENT - PROCEDURES FOR IDENTIFICATION, ACQUISITION, DEVELOPMENT AND USE OF UUT AND TPS DATA
- QUALITY ASSURANCE - PROCEDURES FOR MANAGING A QA PROGRAM FOR COST EFFECTIVE VALIDATION, VERIFICATION AND ACCEPTANCE OF TPS
- INTEGRATED LOGISTICS SUPPORT - PROCEDURES TO INSURE ALL ILS ELEMENTS ARE ADDRESSED THROUGHOUT THE TPS LIFE CYCLE

VOL III, TPS ACQUISITION AND SUPPORT TOOLS

- o PROGRAM MANAGEMENT
  - oo CONFIDENCE LEVEL TRADE MODELS
  - oo MODEL TPS ACQUISITION STATEMENT OF WORK (SOW)
  - oo MODEL INDEPENDENT VALIDATION AND VERIFICATION SOW
- o PROGRAM CONTROL
  - oo COST AND SCHEDULE PERFORMANCE TRACKING
  - oo TPS COST PREDICTION MODEL
- o ENGINEERING
  - oo FAULT ISOLATION DETERMINATION
  - oo MODEL TPS GENERAL AND DETAIL SPECIFICATIONS
- o CONFIGURATION MANAGEMENT
  - oo TPS CONFIGURATION MANAGEMENT PLAN
  - oo TPS CONFIGURATION STATUS ACCOUNTING SYSTEM
- o DATA MANAGEMENT
  - oo TPS DATA ACQUISITION GUIDE
  - oo MODEL SOW FOR ACQUIRING UUT DATA
  - oo TEST REQUIREMENT DOCUMENTATION (TRD)

VOL III TPS ACQUISITION AND SUPPORT TOOLS

(CONT)

- QUALITY ASSURANCE
  - TPS QUALITY ASSURANCE PLAN
  - UUT SOURCE DATA
  - TEST STRATEGY REPORT REVIEW
  - DIGITAL TEST PROGRAM GENERATION SYSTEM EVALUATOR
  - INTEGRATION LOG INITIATION AND REVIEW
  - MODEL GENERAL ACCEPTANCE TEST PLAN AND ACCEPTANCE TEST PROCEDURE
  - FAULT POOL SELECTION
  - ATLAS TEST PROGRAM EFFICIENCY AND APPLICABILITY PROGRAM *
  - ATLAS AMBIGUITY GROUP DISTRIBUTION PROGRAM *
  - ATLAS TEST ACCURACY RATIO EVALUATION PROGRAM *
  - ATLAS LIMIT COMPARISON SOURCE vs CODE PROGRAM *
  - ATLAS FAULT CALLOUT COMPREHENSIVENESS PROGRAM **
  - ATLAS LISTING DEVIATION ANALYSIS PROGRAM **
  - FAULT SELECTION ANALYSIS PROGRAM **
- INTEGRATED LOGISTICS SUPPORT (ILS)
  - TPS ILS PLAN

* MANUAL MODELS AVAILABLE; COMPUTERIZED MODELS BEING DEVELOPED

** MANUAL MODELS AVAILABLE; COMPUTERIZED MODELS PLANNED BUT NOT CURRENTLY FUNDED

RESEARCH AND DEVELOPMENT TECHNICAL REPORT

CECOM-80-0157-F

US ARMY PROPOSED AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY CONCEPT PLAN

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Gregory deMare
Giordano Associates Inc.
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September 1982

Final Report for period September 1981 to May 1982

Prepared for

Program Manager
Test, Measurement and Diagnostic Equipment
ATTN: DRCPM-TMDE-L
Fort Monmouth, N.J. 07703

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The report describes a proposed Automatic Test Equipment (ATE) Software Development and Support Facility which provides a library of standard documentation, test programming aids and tools that will help to develop higher life cycle cost. The content of the library will be available to support all users involved in TPS acquisition and management through various communications links. Typically, the users of the library cover a broad spectrum of interests such as development and readiness staff activities, prime system management offices, prime system and TPS contractors, and depots.

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CONTENTS

1.0 INTRODUCTION

The US Army proposed Software Development and Support Facility will serve as a library for many organizations, government and contractor, that are engaged in specifying, developing and maintaining test program sets. This Facility may not necessarily support the automatic test equipment (ATE) operating system software. Throughout this document the term test program set (TPS) will mean: (a) the applications software or test program (TP) required to test a specific unit under test (UUT), (b) the interface test adapter (ITA) or interface device (ID) that is required to mechanically and electrically connect the automatic test equipment (ATE) to the specific UUT, (c) the test program instruction (TPI) which is the documentation needed to operate and maintain the TP and ITA. The Facility will contain all standard documentation, programming aids and tools necessary to develop and maintain consistently high quality TPS at a reduced life cycle cost (LCC). Through the use of computer communication links, telephone, and mail the Facility will make available the contents of the library to many users. Many different Army and contractor organizations will require access to the Facility. The different agencies include those that:

(a) conduct TPS acquisition planning
(b) conduct TPS acquisition
(c) conduct TPS development
(d) conduct independent TPS validation and verification (V&V)
(e) control and maintain the TPS after deployment

The proposed concept for an ATE software development and support facility is being developed with organizational flexibility as a keystone. The Facility can function within the current or future organization structure of various DARCOM major subordinate commands. Management plans such as the Army Post Deployment Software Support (PDSS) Plans were also considered during the development of this concept.

1.1 Need for an ATE Software Development and Support Facility

During the past several years numerous studies have been conducted on all aspects of supporting weapon (prime) systems to improve operational availability. In all cases the most expensive (approximately 80% of support cost) item with the largest influence on availability was automatic testing. The single most inclusive study was completed in 1980 by five Industry associations at the request of DOD. The Industry/Joint Services Automatic Testing Project (I/JSATP) was completed over a three-year period as a follow-on to a two-year study of Navy automatic testing problems. The I/JSATP involved over 800 people representing 86 corporations, 11 universities and all the Services. The final report was published in June 1980 and currently is being briefed to all the senior command personnel in all development and logistic commands by members of the National Security Industrial Association (NSIA). It provides eleven summary categories of problems and recommends solutions that embody 110 specific recommendations. The recommendations apply to all the Services. Many of these problems are being addressed by the Services through the Joint Logistic Commanders (JLC) Automatic Testing Panel.

The report indicated that DOD was annually spending in excess of $3,200,000,000.00 on automatic testing. Software development cost was over half that figure. Of the $1,600,000,000 software cost, less than 2% is

attributable to the operating system software; the remaining 98% to 99.8% is spent on the application software or test programs. The Army's share of AT cost at that time was approximately $800,000,000 annually; however, that cost is increasing very rapidly. As hundreds of new, highly complex prime systems enter the Army inventory the quantity of testing hardware and software is increasing very rapidly.

The I/JSATP Report stated that: "With complexity and demand increasing ATE acquisition costs, the test program set has emerged as probably the most significant ATE cost driver. The nonrecurring expenses involved in developing the computer-compatible automatic diagnostic test programs have risen significantly over the past decade. TPS cost control is only part of the problem, however. Test program set quality and effectiveness are of equal concern. Unless a test program set is structured for the appropriate maintenance environment, designed for available personnel skill levels, and adequately validated prior to release to the field, its effectiveness quotient will severely hamper the productivity and throughput."

Implementation of the 25 I/JSATP Report TPS related recommendations may be activated through the controlled management approach to test program set development and maintenance through the use of the ATE Software Development and Support Facility. The I/JSATP Report further indicates that implementing these recommendations should reduce the recurring TPS cost by at least 20%. In addition to the cost savings the quality of the TPS's will improve, therefore improving operational availability of the prime system.

In a recent Naval Sea Systems Command and Naval Electronics System Command Study that covered TPS generation for two small digital card testers, a substantial savings was predicted. The study application indicated that for a centralized TPS facility versus unplanned decentralized support a savings of at least $34,000,000.00 will result over a seven-year period. The I/JSATP Report also pointed out the following serious consequences of inaction:

(a) continued high TPS acquisition costs
(b) lengthy and frequently tardy TPS development
(c) continued negative impact of nonstandardization on TPS maintenance
(d) reduced prime system operational availability

In addition to the increasing inventory of complex Army systems, the Army is also facing two additional problems — the reduction of manpower available for service as well as the Army policy of keeping technician training to a minimum. Both of these increase the need for more effective and efficient automatic testing.

The Army's decision to control the proliferation of ATE through the use of standard ATE such as the AN/USM 410 (EQUATE) across multiple weapon systems will reduce cost. However, this action also requires the control of the interface test adapters (ITA) that are developed as part of the test program sets. Uncontrolled proliferation of the ITA's must be reduced. An ITA data base can provide the status of ITA's on specific programs so that parallel or later programs will not need to develop new ITA's. One of the major "lessons learned" from the Navy's Versatile Automated Shop Tester (VAST) Program was that selection of a standard tester did not solve all of the problems. Without control of the TPS the ITA proliferated into large and active devices, causing many operational and support problems that should have been eliminated.

Several years ago the Air Force established six software support centers to maintain the weapon and prime system software. The ATE and TPS software was excluded from initial planning; however, it has since been added to the

software support center's mission. A study conducted during the summer of 1981 indicated that over 75% of software support center's workload was associated with test programs. The original planning had not considered that hundreds of times as many test programs would be prepared as weapon and prime system operating software.

The ATE Software Development and Support Facility will help prevent the TPS software support problem from becoming completely unmanageable by providing the necessary standardized documentation, programming aids and tools to aid in developing TPS. Use of the contents of the library will improve the management, acquisition, development and maintenance of test program sets. Proper and complete use of the Facility will result in improved weapon and prime system availability through improved fault detection and fault isolation while reducing the problems associated with fielding large numbers of complex interface test adapters.

1.2 General Function

The general function of the proposed ATE Software Development and Support Facility is to provide a centralized library of standard documents for TPS development and maintenance programming aids and tools. Access to the library will be maintained through remote computer terminals, telephone and mail, thus reducing the need for many underutilized and duplicative systems. Reduction in duplicative systems will save additional recurring cost based on the number of program offices, developers and maintainers that will not need to procure duplicative capabilities.

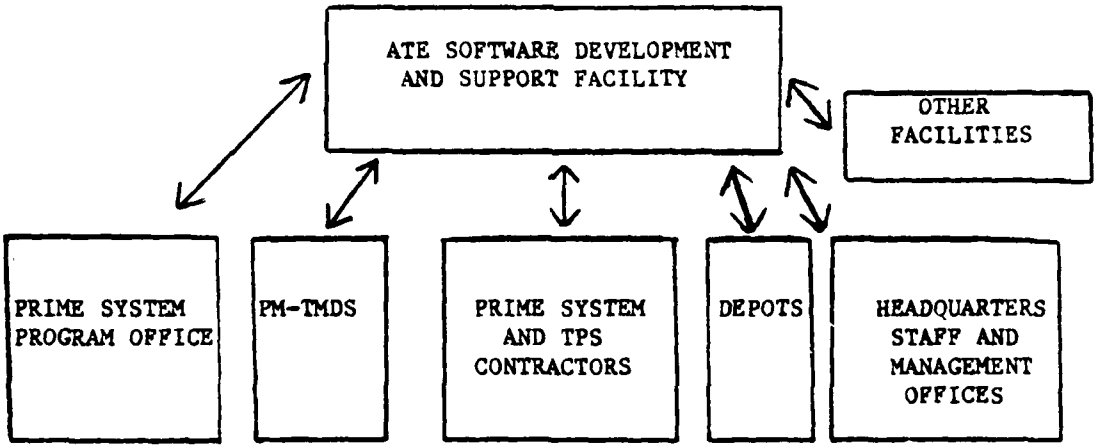

FIGURE 1. COMMUNICATION LINKS

The function of the library is independent of Development and Readiness Command (DARCOM) organizational issues. It will be able to support the TPS development for a variety of prime system program management offices as well as supporting the Post Deployment Software Support (PDSS) Center concepts. The number and physical location of the Facilities should be determined on a workload analysis of the various users or commodity commands.

The actual acquisition, development, and maintenance of the TPS's will be conducted by existing Army offices and contractors. However, the process will be enhanced through a small cadre of highly qualified people located in the

Facilities. The cadre will maintain the library and arrange for updates as well as provide training on the availability and use of the various documents, aids and tools contained in the library.

Whenever possible, the contents of the library will be selected from existing projects or those under development by the Army, Air Force or Navy. In some cases the existing products may have to be modified to provide a more standardized product for Army-wide application. Occasionally a new product will need to be developed to improve the quality of TPS's. However, the function of the facility is not to develop tools and aids, but to host them. All products will be tailored to meet the needs of various disciplines involved in acquisition, development and maintenance of TPS. Representative disciplines are:

(a) Program Management
(b) Program Control
(c) Engineering
(d) Configuration Management
(e) Data Management
(f) Quality Assurance
(g) Integrated Logistics Support
(h) Programmers
(i) ITA Fabricators
(j) TPS Maintainers

1.3 Concept Evolution

The concept evolution for the ATE Software Development and Support Facility has followed a top-down successive refinement technique. A baseline concept was defined from a top-level review of future Army TPS requirements. It considers the nearly exponential growth in TPS development and support resulting from the large numbers of complex weapon and prime systems that are beginning to enter the Army inventory. It is also based on a review of all DARCOM major subordinate commands current and planned programs that have developed, or are developing, as well as TPS documentation standards, programming aids and tools. The initial concept also is based on a knowledge of TPS tasks being conducted under the auspices of the Joint Logistics Commanders Automatic Testing Panel, appendix B., and related Air Force and Navy projects.

The initial ATE Software Development and Support Facility concept has been presented to several Army organizations. After each presentation active discussion ensued, resulting in additional items being added to the Facility and existing concepts being modified based on the experiences of personnel present at the briefings.

The concept is evolving through this direct contact with Army personnel involved in all aspects of TPS development and support ranging from policy to hands-on maintenance.

Many DOD and Army policies are also being incorporated into the Facility concept. For example the following were considered:

(a) DOD policies on automated data systems and embedded computer management
(b) DOD policy to use IEEE Std 716-1982 Common ATLAS as the programming language for all future test programs
(c) the DARCOM policy to use the AN/USM 410 (EQUATE) for all future general support and depot testing requirements

The concept recognizes that a large percentage of the TPS developed

during the next few years will operate on the AN/USM 410. However, in the near term, many TPS's will be developed for other general support (GS) and depot ATE that are currently entering the inventory. It also recognizes that thousands of TPS's will be developed to run on the many and varied ATE being developed to support hundreds of prime systems at organizational and direct support levels of maintenance.

Visits with personnel in the following organizations have been completed:

(a) Communication Electronics Command
    Headquarters Staff
    Integrated Logistics Support Division
    Center for Tactical Computer Systems
    Product Manager - Test Measurement and Diagnostic Systems
(b) Depot Systems Command
    Headquarters Staff
(c) Tobyhanna Army Depot
    Automated Systems Division
(d) RCA Burlington MA
    ATE Staff
    EQUATE (AN/USM 410)
    STE/ICE and derivatives
(e) Sacramento Army Depot
(f) Missile Command Headquarters

Visits are being scheduled at the following organizations:

(a) Armament R & D Command
(b) Armament Readiness Command
(c) Tank and Automotive Command
(d) Central Test Measurement and Diagnostic Equipment Activity

Additional details on the ATE Software Development and Support Facility will be provided in the following documents:

(a) ATE Software Development and Support Facility
    Functional Requirements Document, August 1982
(b) ATE Software Development and Support Facility
    Preliminary Design Specification, October 1982
(c) ATE Software Development and Support Facility
    Implementation Plan, October 1982

2.0 FACILITY CONCEPT DESCRIPTION

This section provides a general description of the ATE Software Development and Support Facility and the products available through the library. Details will be provided in the functional requirements document, preliminary design specification, and the implementation plan. The Facility is structured to meet the objectives of providing DARCOM major subordinate commands, program managers, contractors, and maintenance activities with necessary guides, hardware and software required to develop and maintain high quality TPS at a reduced cost. The key to the Facility's meeting the objectives is that the total contents of the library must be readily available to all users in a timely manner. Therefore, the Facility must have responsive communication links as well as documents and training courses to inform users of the content of the library and provide instructions on how to use the various library products.

In many cases the library products are not new or unique; however, many of them may be used by only one DARCOM major subordinate command, one program office, one location, or one contractor. What is new is the concept of making all of the items available to all users. The number and location of Facilities will be determined by a workload analysis at a later date.

The following paragraphs present a general discussion of the communication system, standard documentation, programming aids and tools.

2.1 Communication System

The communication system is critical to the ATE Software Development and Support Facility. Through the communication links all users will be able to access the library and use the various products. A normal telephone with telecopiers will provide a link for consulting on general matters and will provide timely instructions on accessing the library. Conventional mail and air express shipments can be used to handle large bulk transmittals of data. However, the majority of communication will be provided through a computer hookup with the various users' terminals and mainframes.

The communication computer must have a multi-tasking and multi-programming operating system. It must permit many simultaneous users to rapidly access the various automatic test program generators (ATPG), translators, and data bases.

2.2 Standard Documentation

The standard documentation required in the Facility are many and varied; in general they will consist of all the documents needed to contract for and to develop high quality, cost effective test program sets. The current status of identified standard documentation is shown in appendix A. To improve the dissemination and currency of the documents, many, if not all, should be available through a data base management system (DBMS) as well as hard copy. The following provides a description of the type of standard documents that are required:

(a) Facility Guide and Training Course - will provide a description of what is contained in the library with instructions on how to access and use the various items.

(b) Test Program Set Acquisition Guide - will provide a "how-to" description of TPS acquisition. The guide should contain flow charts that indicate when the tasks should be completed, who should accomplish the task, and what supporting documentation is available. The guide should be structured to match various acquisition scenarios, such as concurrent with the prime system contract award, after prime system award, and after the prime system is fielded.

(c) Design for Testability Guide - will provide design techniques for use by the weapon system, prime system and automatic test equipment designers to make testing easier, thereby reducing TPS complexity and cost.

d) Test Requirement Document (TRD) Standard - will provide a standard that specifies what type data must be acquired for TPS development, when it is needed, and the format the data must be in.

e) Model Unit Under Test (UUT) Test Requirements Document (TRD) Statement of Work (SOW) - will provide an on-line standard model SOW and appropriate contract data requirements list (CDRL), as well as data item descriptions (DID's) for incorporation into prime system

contracts to acquire the unit under test (UUT) TRD data as part of the prime system contract or after the fact. The SOW will be tailored for specific UUT's through queries and reference to boilerplate contained in the data base.

(f) Model Test Program Set (TPS) Statement of Work (SOW) - will provide an on-line standard model TPS SOW and DID's that can be used to contract for the TPS as part of the prime system contract or as a separate contract. The SOW will be tailored through queries and reference to boilerplate contained in the data base.

(g) Model Test Program Set (TPS) Specifications - will provide on-line model system and performance specifications that can be tailored to define the TPS requirements through user queries.

(h) ATLAS Standard - will provide copies of IEEE Std 716-1982 common ATLAS which is the DOD directed standard language for preparing test programs.

(i) Other Languages - will provide copies of manuals covering languages in widespread Army use, such as EQUATE ATLAS.

(j) Test Program Set (TPS) Configuration Management (CM) Plans - will provide an on-line model TPS CM plan that can be easily tailored and included in various TPS acquisition contracts; Army depots that will be maintaining the TPS may also use a standard TPS CM plan.

(k) Model TPS Integrated Logistic Support (ILS) Plan - will provide an on-line computer program that through user query and reference to boilerplate will generate a tailored TPS ILS plan.

(l) Model TPS Quality Assurance Plan - will provide an on-line computer program that will generate a tailored TPS quality assurance plan through user query and reference to boilerplate.

(m) Model TPS Request For Proposal (RFP) - will provide an on-line computer program which embodies Army policy with respect to TPS procurement. A TPS Development RFP can be developed through user query and reference to boilerplate.

(n) TPS Style Guide, - will provide a Test Program Style Guide outlining common format, flow charts, etc., to aid in reducing the diverse means of documenting TPS. A common style should reduce the time and cost to maintain future TPS.

2.3 Programming Aids

Programming aids are defined as a group of data base systems that provide information to be used in developing test program sets. Also included are data bases that are part of a repairable management system. All of the data bases will be accessible through remote terminals. If required, special access codes can be used to restrict contractor use of data bases that contain proprietary data provided by other companies. The current status of identified programming aids is shown in appendix A.

The following provides a description of the type of programming aids that are required:

(a) TPS Life Cycle Cost (LCC) Prediction Model - will provide mathematical models for estimating total cost of developing and maintaining TPS's over the life of a weapon or prime system.

(b) TPS Development Cost Models - will provide mathematical models to estimate cost of developing TPS's during the conceptual and validation phases of weapon and prime system development.

(c) TPS Schedule and Cost Tracking System - will provide a system that can easily track current performance and cost against predicted cost. The system will also provide feedback to update the cost prediction models.

(d) Unit Under Test (UUT) Failure Data Collection System - will provide a computer aided system for collecting, organizing and storing data on type and frequency of UUT failures. The system should also track and provide an analysis of retest - OK (RTOK) and cannot duplicate (CND) actions. The total analysis should be automatically completed by grouping common classes of faults as well as faults identified against a specific serial numbered shop replacement unit (SRU) or line replacement unit (LRU). The data gathering aspect of this can be automated as part of the ATE operating system.

(e) ATE/TPS Operations Data Collection System - will provide a computer aided system for collecting, organizing and saving data about ATE and TPS usage, effectiveness and support cost.

(f) TPS Acquisition Data Collection System - will provide a computer aided system for collecting, allocating and storing data about manpower, material and costs of TPS development. Included also will be Army cost for preparing request-for-proposals (RFP's), conducting source selection, contract award and contract monitoring.

(g) Library of ATLAS Procedures - will provide a library of ATLAS procedures to be used in developing a TPS. The procedures will aid in standardizing the resulting TPS and simplifying the coding process.

(h) Unit Under Test (UUT) versus Automatic Test Equipment (ATE) and Interface Test Adapter (ITA) Matching Algorithm - will provide a computer data base system that will aid in matching new UUT testing requirements with existing ATE and ITA.

(i) Computer Aided Design (CAD) for Interface Test Adapters (ITA's) - will provide an on-line CAD system that will support the design of ITA's.

(j) Graphics Development Aids - will provide a computer aided system to assist in development of software that will provide a detailed display of the testing flow to the ATE operator.

(k) TPS Fault Isolation Models - will provide a computer system to aid in predicting the fault isolation potential for TPS's to be used in developing test specifications.

(l) TPS Quality Assurance - will provide computer quality assurance systems to aid in developing, validating and verifying (V&V) TPS. The models should permit assessment at several different points in the development process. The first assessment shall be conducted prior to coding the test program.

(m) Workload Analysis System - will provide as part of a repairable management system an on-line data system that consists of classification and distribution profiles of repairables and matches these profiles to the available maintenance assessment required to test and repair the failed UUT.

(n) ATE/TPS Operation Model - will provide as part of a repairable management system a model for estimating the ATE Software Development and Support Facility workload, turnaround time, etc.

(o) Depot and General Support (GS) ATE Shop Scheduling System - will provide as part of a repairable management system an on-line computer program that will accept user specified constraints and then provide a repair schedule that guarantees optimum shop throughput.

(p) TPS Developer Configuration Status Accounting System (CSAS) - will

provide an on-line computer program and a set of procedures that will permit the Army or contractor TPS developer to keep track of the UUT, ATE and TPS configuration during the TPS development phase.

(q) Army TPS Management Configuration Status Accounting System (CSAS) - will provide an on-line computer program and a set of procedures that will permit the Army organizations responsible for tracking and maintaining the TPS to keep track of the UUT, ATE and TPS configuration after deployment. The Army TPS management CSAS will not track some of the milestones included in the developer CSAS such as interim changes during quality assurance and validation and verification checks; however, it will contain additional information such as TPS physical location and status of engineering change proposals (ECP's) that affect the TPS.

(r) Shop Testing Capabilities System - will provide as part of a repairable management system an on-line data system that will display an assessment of the shop testing capabilities. The assessment will indicate what UUT's can be tested with the assigned ATE and TPS based on the current configuration of ATE, TPS and UUT. It also will provide an assessment based on degraded ATE's or ITA's capabilities due to failures. The data base can be established to obtain automatic updates from the command configuration status accounting system.

(s) Deficiency Reporting and Feedback System - will permit a rapid transmission of TPS deficiencies to a central organization. The system should also provide for a rapid feedback on workaround procedures and the schedule for deficiency correction.

(t) Word Processor - provides a word processor computer program for preparing and updating the test proposal instructions (TPI's). The word processor will also be available to update the various standard documentation included within the Facility.

2.4 Programming Tools

Programming tools are defined as a group of computer based systems that are used directly by the programmers to develop test programs. There are many existing tools that perform similar functions; therefore, one of the major tasks in this area will be to identify a specific tool or a family of related tools for inclusion in the Facility. The following provides a description of the programming tools that are required:

(a) Digital Automatic Test Pattern Generator (ATPG) - provides a family of computer programs that will analyze a digital circuit description of a UUT and generate a test program for that UUT.

(b) Digital Simulator - provides a family of computer programs that will evaluate the fault detection effectiveness of a digital test. The program should also generate test responses and fault isolation data.

(c) Analog Automatic Test Program Generator (ATPG) - provides a computer program that will analyze an analog circuit description and generate a test program for that UUT.

(d) ATLAS Flowchart Generator - provides a computer program for analyzing a test program written in ATLAS and automatically generates a pictorial and commented flowchart of the program.

(e) Text Editor - provides an on-line computer program for viewing and modifying computer programs.

(f) IEEE Std 716, Common ATLAS Compiler and Syntax Checker - provides a

portable IEEE Std 716 ATLAS Compiler that will check the syntax of ATLAS programs, provide appropriate warning and error messages, and translate the 716 ATLAS code into an intermediate code or into a format suitable for execution on a specific test station.

(g) EQUATE ATLAS Compiler and Syntax Checker - provides an EQUATE ATLAS Compiler that will check the syntax of EQUATE test programs, provide appropriate warning and error messages, and translate the EQUATE ATLAS into a format suitable for execution on a AN/USM 410.

(h) Other compilers and syntax checkers - provide the additional compilers and syntax checkers that are required to support the assigned TPS.

(i) Translators - provide a family of translators capable of translating test programs written on one tester to operate on another tester or from one language to another. For example, AN/USM 410 ATE to GENRAD 2225 ATE, Chrysler DSETS Language to IEEE Std 716 Common ATLAS, EQUATE ATLAS Language to IEEE Std 716 Common ATLAS, IEEE Std 716 Common ATLAS to EQUATE ATLAS etc.

(j) Failure Modes Effects Analysis (FMEA) to ATLAS Translator - provides an on-line computer program that will translate the FMEA failure signatures directly into the diagnostic portion of an IEEE Std 716 Common ATLAS test program.

(k) ATLAS Composing Terminal - provides an on-line computer program that through templates or some other means lead a technician through the process of developing IEEE Std 716 ATLAS test programs. The system should accept test requirement document (TRD) data and develop a test program as well as accept detailed source data and generate both a TRD and a test program.

(l) Self Learning TP Generator - provides a self learning test program generator using knowledge based system (KBS) and artificial intelligence (AI) technology. The self learning generator will be able to automatically improve the test program based on actual testing data.

(m) Test Program Development Stations - provide the necessary test program development stations, including EQUATE ATLAS and Common ATLAS Compilers, to permit initial development of test programs without using the complete ATE stations.

(n) ATE Simulator - will be provided to conduct off-line testing for logic and parameter errors during execution of ATLAS programs.

3.0 RELATIONSHIP TO DARCOM PDSS CENTERS

The major subordinate commands are each currently developing plans for implementing the Post Deployment Software Support concepts (PDSS). Each of the plans are evolving along independent lines. At this time each command is planning to establish one or more centers to maintain the operational software. Several draft PDSS documents and major system command messages were reviewed to determine the relationship of the planned PDSS Facilities to TPS support. The various PDSS center plans ranged from specifically excluding TPS's, to including only the AN/USM 410 TPS's, to implying that all TPS's will be controlled/maintained by the respective PDSS centers.

As stated previously in this Facility Concept Plan, the ATE Software Development and Support Facility will remain completely flexible. It will be possible to tailor the Facility to match the final command decisions on

supporting TPS within or outside the PDSS centers. This inherent flexibility is possible because the ATE Software Development and Support Facility is a library of test program set standard documentation, programming aids and tools, available for all users. The actual TPS development and maintenance will be conducted by other Army organizations or contractors.

4.0 CONCLUSION

(a) The proposed ATE Software Development and Support Facility Concept Plan indicates that the Facility will provide a viable opportunity for the Army to:

(1) have better and more comprehensive fault detection and isolation thereby reducing test time and improving the quality of the diagnosed unit under test (UUT), and increasing prime system availability.
(2) begin to control the proliferation of test programming aids and tools, thus reducing acquisition support cost.
(3) reduce proliferation of complex interface test adapters that must be maintained and transported in the field.
(4) improve the quality of delivered test programs through improved acquisition procedures and development aids and tools.

(b) There will be a net reduction in the need for skilled manpower as a few centralized Facilities will be used rather than manning dozens of duplicative systems.

(c) There will be a net reduction in cost as each of the prime system program management offices will not need to develop, buy or lease duplicative capabilities.

APPENDIX A

STATUS OF IDENTIFIED LIBRARY CONTENTS

PARAGRAPH NUMBER AND ITEM	STATUS (1)	(2)	(3)	(4)	(5)
2.2 STANDARD DOCUMENTATION					
(a) Facility Guide and Course					X
(b) Test Program Set Acquisition Guide *		X	X		
(c) Design for Testability Guide *		X	X		
(d) Test Requirement Document (TRD) Standard *		X			
(e) Model Unit Under Test TRD SOW *	X		X		
(f) Model TPS SOW *	X		X		
(g) Model TPS Specifications *	X		X		
(h) ATLAS Standard	X				
(i) Other Languages	X				
(j) TPS Configuration Management Plan *	X	X		X	
(k) Model TPS ILS Plan *	X		X		
(l) Model TPS Quality Assurance Plan *	X		X		
(m) Model TPS Request for Proposal (RFP) *	X		X		
(n) TPS Style Guide	X	X		X	
2.3 PROGRAMMING AIDS					
(a) TPS Life Cycle Cost Prediction Model *	X	X	X		
(b) TPS Development Cost Models	X	X	X		
(c) TPS Schedule and Cost Tracking System *		X	X		
(d) UUT Failure Data Collection System					X
(e) ATE/TPS Operations Data Collection System		X			X
(f) TPS Acquisition Data Collection System		X	X	X	
(g) Library of Atlas Procedures		X			X
(h) UUT vs ATE and ITA Matching Algorithm					X
(i) CAD for ITA	X			X	
(j) Graphics Development Aids					X
(k) TPS Fault Isolation Models					X
(l) TPS Quality Assurance *		X			X
(m) Workload Analysis System					X
(n) ATE/TPS Operation Model					X
(o) Depot and GS ATE Shop Scheduling System **		X	X		X
(p) TPS Developer Configuration Status * Accounting System	X	X		X	X
(q) Army TPS Management Configuration * Status Accounting System	X	X		X	X
(r) Shop Testing Capabilities System					X
(s) Deficiency Reporting and Feedback System					X
(t) Word Processor	X			X	
(u) UUT Failure Data Collection System					X

APPENDIX A

STATUS OF IDENTIFIED LIBRARY CONTENTS(Con'd.)

PARAGRAPH NUMBER AND ITEM	STATUS (1)	(2)	(3)	(4)	(5)
2.4 PROGRAMMING TOOLS					
(a) Digital ATPG	X	X		X	
(b) Digital Simulator	X	X		X	
(c) Analog ATPG					X
(d) ATLAS Flowchart Generator	X		X		
(e) Text Editor	X		X	X	
(f) IEEE Std 716 Common ATLAS Compiler and Syntax Checker	X		X	X	
(g) RCA EQUATE ATLAS Compiler and Syntax Checker	X				
(h) Other Compilers and Syntax Checkers	X				
(i) Translators					X
(j) FMEA to ATLAS Translator					X
(k) ATLAS Composing Terminal		X			X
(l) Self Learning Test Program Generator					X
(m) Test Program Development Stations	X				X
(n) ATE Simulator					X
(o) EQUATE TPS Generation Station	X				

LEGEND

*Partially being Developed by Air Force MATE Program	(1) EXISTS	(4) REQUIRES CHOICE OF ONE AS A STANDARD
**Partially being Developed by Navy CSS Program	(2) UNDER DEVELOPMENT	
	(3) NEEDS TAILORING FOR ARMY	(5) NEEDS DEVELOPMENT

APPENDIX B

RELATED JOINT LOGISTICS COMMANDERS (JLC) PANEL

ON AUTOMATIC TESTING

SUBTASKS

I. JLC PANEL ON AUTOMATIC TESTING RELATED MANAGEMENT SUBTASKS (AUG 81)

II. JLC PANEL ON AUTOMATIC TESTING RELATED ACQUISITION SUPPORT TASKS (AUG 81)

III. JLC PANEL ON AUTOMATIC TESTING RELATED TESTING TECHNOLOGY SUBTASKS (AUG 81)

I. JLC PANEL ON AUTOMATIC RELATED MANAGEMENT SUBTASKS (AUG 81)

SUBTASK MIS CODE	SUBTASK TITLE	OFFICE OF PRIMARY RESPONSIBILITY (OPR)
10102	DOCUMENT CHANGES	P. GROSS/NMC
10201	DATA ITEM DESCRIPTION LIST	J. JOHNSON/AFLC
10202	DATA ITEM DESCRIPTION IMPLEMENTATION	J. JOHNSON/AFLC
10602	MANAGEMENT INFORMATION SYSTEM	P. GROSS/NMC

II. JLC PANEL ON AUTOMATIC TESTING RELATED ACQUISITION SUPPORT TASKS (AUG 81)

20101	ISSUE JOINT SERVICE TERMINOLOGY STANDARD	CDR SANBORN/NMC
20201	JOINT SERVICE AT INFORMATION EXCHANGE SYSTEM	J. DEWEY/AFLC
20302	ELECTRONIC TESTABILITY GUIDE	E. WOLANSKI/AFSC
20303	NON-ELECTRONIC TESTABILITY GUIDE	W. HNATCZUK/DARCOM
20304	TESTABILITY SPECIFICATION	E. WOLANSKI/AFSC
20305	TESTABILITY PROGRAM REVIEW	P. GROSS/NMC
20402	LCC/SYSTEMS ENGINEERING MODELS	MAJ. FREEMAN/AFSC
20501	TEST PROGRAM SET DESIGN HANDBOOK	D. CROKE/NMC
20502	DIGITAL ATG SELECTION GUIDE	P. GROSS
20503	TPS ACQUISITION GUIDE	H. KIESEL/AFSC
20504	TPS VALIDATION AND VERIFICATION GUIDE	H. KIESEL/AFSC
20505	REVISE MIL STD 881	P. HOLUB/DARCOM OPR
20506	ATLAS SOURCE CODE CONTROL	D. CROKE/NMC
20601	HARDWARE INTERFACE SPECIFICATION	D. BROWN/AFSC
20801	ANALYZE AND ISSUE TRD STANDARD	B. DALTRY/AFSC

III. JLC PANEL ON AUTOMATIC TESTING RELATED TESTING TECHNOLOGY SUBTASKS (AUG 81)

SUBTASK MIS CODE	SUBTASK TITLE	OFFICE OF PRIMARY RESPONSIBILITY (OPR)
30101	TPS COST ESTIMATION TECHNIQUES	H KIESEL/AFSC

30103	TEST APPLICATIONS PROGRAMS	DR. ALLEN/AFSC
30105	ATE SELF TEST SOFTWARE	A. PUPA/NMC
30107	ANSI/IEEE-STD-716, BASIC ATLAS (DOD APPROVED SUBSET OF ANSI/IEEE-STD-416, ATLAS)	G. KONOMOS/AFSC
30108	DEVELOP COMMON FACILITATING SOFTWARE	D. CROKE/NMC
30110	TEST PROGRAM SET VERIFICATION, VALIDATION AND ACCEPTANCE TOOLS	H. KIESEL/AFSC
30111	BASIC ATLAS COMPILER	G. KONOMOS/AFSC
30201	DEVELOP ANALOG ATPG SYSTEM	H. KIESEL/AFSC
30202	DEVELOP DIGITAL ATG SYSTEM	R. EPSTEIN/NMC
30508	SYSTEM OF SELF-IMPROVING DIAGNOSTICS	H. KIESEL/AFSC

APPENDIX C

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APPENDIX D

ABBREVIATIONS

AI	Artificial Intelligence
ARCOM	Armament Command
ATE	Automatic Test Equipment
ATLAS	Abbreviated Test Language for All Systems
ATPG	Automatic Test Pattern Generator
AVCOM	Aviation Command
CAD	Computer Aided Design
C/ATLAS	Common Abbreviated Test Language for All Systems
CDRL	Contract Data Requirements List
CECOM	Communications Electronics Command
CM	Configuration Management
CND	Cannot Duplicate
CSAS	Configuration Status Accounting System
CSS	Consolidated Support System
DARCOM	Development and Readiness Command
DBMS	Data Base Management System
DESCOM	Depot System Command
DID	Data Item Description
DS	Direct Support
DSETS	Direct Support Electrical Test Set
ECP	Engineering Change Proposal
FMEA	Failure Modes Effects Analysis
GS	General Support
ID	Interface Device
I/JSATP	Industry/Joint Services Automatic Testing Project
ILS	Integrated Logistic Support
ITA	Interface Test Adapter
JLC	Joint Logistic Commanders
KBS	Knowledge Based System
LCC	Life Cycle Cost
LRU	Line Replacement Unit
MATE	Modular Automatic Test Equipment
MICOM	Missile Command
MIS	Management Information System
NAVELEX	Naval Electronics System Command
NAVSEA	Naval Sea System Command
NSIA	National Security Industrial Association
OPR	Office of Primary Responsibility
PDSS	Post Deployment Software Support
PM-TMDS	Product Manager-Test Measurement and Diagnostic Systems
RFP	Request for Proposal
RTOK	Retest - OK
SOW	Statement of Work
SRU	Shop Replacement Unit
TMDS	Test Measurement and Diagnostic Systems
TOAD	Tobyhanna Army Depot
TP	Test Program
TPI	Test Program Instruction
TPS	Test Program Set
TRA	Test Requirements Analysis
TRD	Test Requirement Document
UUT	Unit Under Test
V&V	Validation and Verification
VAST	Versatile Automated Shop Tester

DAAK 80-81-C-0157-II

US ARMY

PROPOSED

AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

FUNCTIONAL REQUIREMENTS DOCUMENT

5 SEPTEMBER 1982

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COMMUNICATION ELECTRONICS COMMAND

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) When in full operation the ATE Software Development and Support Facility will encompass a broad spectrum of functions pertaining to the specifying, developing, and maintaining of Test Program Sets (TPS). A library will be set up consisting of standard documentation, test programming aids and tools whose purpose will be to develop high quality TPS at a reduced Life Cycle Cost (LCC).		

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20. ABSTRACT (Continued)

Users of the Facility will find the library functions as a:

a. focal point for information on TPS acquisition and development problems,

b. means to predict the cost for TPS development and then track the actual cost during the life cycle of the TPS,

c. source of guidance on preparation of TPS documents,

d. means to consolidate and transmit users' problems,

e. support facility to aid in matching shop test assets to UUT's and spare parts.

In order to support TPS development and maintenance agencies' requirements the above functions must be performed. To complete the required functions the Facility (library) must provide configuration status accounting system capabilities, automatic test program generators (ATPG's) and simulators, a family of ATLAS compilers, composing terminals, programming stations, plus other programming aids, programming tools and standard acquisition and support documentation.

With all facets of the Facility in place, it will then be capable of making the most efficient use of limited manpower resources while continuing to function within the current or future organization structure of DARCOM major subordinate commands.

CONTENTS

1.0 INTRODUCTION

The US Army proposed Software Development and Support Facility will serve as a library for many organizations, government and contractor, that are engaged in specifying, developing and maintaining test program sets. At this time the Facility concept does not include support of the automatic test equipment (ATE) operating system software; however, it can be expanded to include new support philosophies. Throughout this document the term test program set (TPS) will mean: a) the applications software or test program (TP) required to test a specific unit under test (UUT), b) the interface test adapter (ITA) or interface device (ID) that is required to mechanically and electrically connect the automatic test equipment (ATE) to the specific UUT, c) the test program instruction (TPI) which is the documentation needed to operate and maintain the TP and ITA. The Facility will contain all standard documentation, programming aids and tools necessary to develop and maintain consistently high quality TPS at a reduced life cycle cost (LCC). Through the use of computer communication links, telephone, and mail, the Facility will make available the contents of the library to many users. Many different Army and contractor organizations will require access to the Facility. The different agencies include those that:

(a) conduct TPS acquisition planning

(b) conduct TPS acquisition

(c) conduct TPS development

(d) conduct independent TPS validation and verification (V&V)

(e) control and maintain the TPS after deployment

The proposed concept for an ATE software development and support facility is being developed with organizational flexibility as a keystone. The Facility can function within the current or future organization structure of various DARCOM major subordinate commands. Management plans such as the Army Post Deployment Software Support (PDSS) Plans and the Army Test Program Set (TPS) Management Plan were also considered during the development of this concept.

Additional details on the need for the Facility and the concept evolution are contained in the "US Army proposed ATE Software Development and Support Facility Concept Plan" of 28 April 1982.

1.1 Functional Requirements Document Objectives

This document specifies the functional requirements that the Facility must satisfy. The functional requirements document also provides a basis for the mutual understanding between the designers and users of the Facility.

1.2 Facility Concept Summary

Currently the Army is experiencing an explosive growth in the acquisition of complex electronic systems. The fielding of the complex systems in the face of a reduced manpower pool and reduced technical training, thus lower skill levels, is accelerating the requirement for automatic testing at all levels of maintenance. A 1980 Industry/Joint Services Automatic Testing Project study indicated that the US Army was spending approximately $800,000,000.00 annually on automatic testing. Over 50% of this figure is for development of the software included in the test program sets.

The proposed ATE Software Development and Support Facilities will provide a library of standard documentation, test programming aids and tools that will help to develop higher quality test program sets (TPS) at a reduced life cycle cost (LCC). The content of the libraries will be available to all users through various communication links; therefore, it will not be necessary for all users to procure duplicative aids and tools. The users of the library cover a broad spectrum of personnel ranging from Development and Readiness Command Headquarters Staff, major subordinate command headquarters staff and management offices, prime system program management offices, prime system and TPS contractors, to depots.

Due to the flexibility inherent in the Facility it can be tailored to fit into the Army Post Deployment Software Support Center concepts and the Army TPS Management Plan as they evolve. The number and location of Facilities are also flexible and can be determined by a detailed work load analysis.

(a) The proposed ATE Software Development and Support Facility Concept Plan indicates that the Facility will provide a viable opportunity for the Army to:

(1) obtain better and more comprehensive fault detection and isolation, thus improving the quality of the diagnosed unit under test (UUT) and increasing prime system availability.

(2) begin to control the proliferation of test programming aids and tools, thus reducing acquisition support costs.

(3) reduce proliferation of complex interface test adapters that must be maintained and transported in the field.

(4) improve the quality of delivered test programs through improved acquisition procedures and development aids and tools.

(b) There will be a net reduction in skilled manpower as a few centralized Facilities will be used rather than manning dozens of duplicative systems.

(c) There will be a net reduction in cost as each of the prime system program management offices will not need to develop, buy, or lease duplicative capabilities.

Additional details on the Facility are contained in the U. S. Army proposed ATE Software Development and Support Facility Concept Plan, Implementation Plan, and Preliminary Design Specification. The Facility Concept Description, paragraph 2.0 of the Concept Plan is included in this document as Appendix C.

2.0 FACILITY FUNCTIONAL REQUIREMENTS

The functions of the ATE Software Development and Support Facility are varied and will require a broad range of standard documentation, programming aids and programming tools to meet the requirements. The functions fall within three major categories; however, there are some overlapping functions. The first category contains functions that the acquisition agency must do to plan, budget, contract, monitor and accept test program sets. For purposes of this report the acquisition agency is defined as the program management office, depot or contractor that will contract for the TPS development. The second category contains functions that the test

program set developers and maintainers must perform to prepare, verify, validate, update, repair, and track the configuration and location of the TPS's. The TPS maintainers are defined as the various Army organic depots as well as the contractor operated facilities that will update and maintain the test program sets. The third category contains functions that the prime system maintenance shops must perform when they use the ATE and TPS to fault diagnose, fault isolate and repair the units under test.

The preceding categories are useful to group the various functions; however, the Army organizations that actually complete the functions are varied. For example, in one case the prime weapon system program management office will complete the category one functions, the prime contractor will complete the category two TPS development functions, a contractor depot will complete the category two TPS maintence functions, and the Army general support level maintenance shop will complete the category three functions. In another case an Army depot will complete the functions in all three categories.

Appendix A provides a detailed matrix that cross references the contents of the Facility as specified in the Concept Plan with the Facility functions that are described in the following subparagraphs.

2.1 Functions Required To Support TPS Acquisition Agencies

Acquisition agencies are defined as the program management office, depot or contractor that accomplish the following functions to enable them to plan, budget, contract for, monitor and accept test program sets:

1. act as focal point for test program set acquisition problems
2. provide means to predict and track cost for test program set (TPS)

development

3. provide guidance on preparation of test program set acquisition documents
4. provide a means to consolidate test program set users' problems for transmission to development agencies
5. provide Configuration Status Accounting System (CSAS) capabilities

2.1.1 Act As Focal Point For Test Program Set Acquisition Problems

To be responsive to Army needs the library must be able to respond to new and ever-changing requirements. To accomplish this purpose, the Facility must have the means to collect information on TPS acquisition problems as well as development problems. The Facility should then provide concise information on TPS standards, aids and tools requirements to the appropriate development agency. The development agency will then procure the necessary items to permit solving the myriad of problems. Through this process the Facility will always contain the latest technology to aid in reducing the cost and time to develop and maintain high quality TPS.

The Facility must be able to plan and schedule the use of all the items contained in it so each user will have access when required.

The Facility must also have the capability to identify and contact various experts throughout the Army who can provide advice on solving new and unique problems related to TPS's.

To assure the optimum use of the various library contents, the Facility must be capable of providing training on the use of the various standards, aids and tools provided.

2.1.2 Provide Means To Predict And Track Cost For TPS Development

One critical function that the Facility must satisfy is to provide a means to predict the cost for TPS development and then track the actual cost during the life cycle of TPS. One of the most critical problems facing each new prime system program manager is to accurately budget the required funds and appropriate cash flow to permit meeting overall performance and schedule requirements. As the TPS will require the majority of the support dollars, it is imperative that TPS cost prediction models based on historical experience be made available. After the TPS development has begun, it is also imperative that the program management office be able to identify the actual cost for the various hardware, software and documentation that comprise the TPS. The accumulated cost data should also feed back to the cost prediction models to provide an update for future prime system program managers.

2.1.3 Provide Guidance On Preparation Of TPS Acquisition Documents

During the initial formation of prime system program management offices and drafting of the various acquisition documents, the availability of qualified personnel is normally very limited. Therefore, to help alleviate this problem, the Facility should provide various data bases, guides and model documents based on successful programs to augment the limited personnel. The various documents and data bases must be easily accessible to the users and must permit tailoring to the unique requirements of the programs.

2.1.4 Provide A Means To Consolidate TPS Users' Problems For Transmission To Development Agencies

The Facility must provide a means to easily obtain user data on the

effectiveness of the TPS in field use. It also must provide the means to assure that all of the identified deficiencies are properly categorized with appropriate priorities and relayed to the proper maintenance or acquisition agency for resolution.

2.1.5 Provide Configuration Status Accounting System (CSAS) Capabilities

The Facility must provide the various data bases that will enable the TPS development and maintenance agencies to complete their configuration status accounting functions. The diverse nature of test program sets containing hardware, software and documentation coupled with the large number of TPS's entering the Army inventory requires a responsive CSAS that can be readily tailored to each user's needs. The CSAS also should provide appropriate acquisition agencies with the capability to trace the engineering change proposal and modification status of selected TPS's.

Effective management of development, duplication, distribution, and post-deployment support of TPS's requires careful definition of all baseline components; changes to those components also need to be defined since these changes together with the baselines specify the TPS evolution. This process, known as Configuration Identification, is an essential input to the Configuration Status Accounting (CSA) effort. CSA is a mechanism for maintaining a record of how the TPS or ATE has evolved and where the item is at any time relative to what appears in the published baseline documentation. ATE and TPS CSA is the administrative tracking and reporting of all items formally identified and controlled. It also involves the maintenance of records to support the ATE/TPS configuration auditing process. ATE/TPS CSA requires inputs from all the functions of

across this spectrum, several ATPG's and simulators will be required to support the Facility users.

Selecting and standardizing certain test program generating aids is essential to successful TPS development and post-deployment support efforts. The most efficient and effective approach to validation and verification (V&V) of TPS requires complete knowledge of the test program design strategy/methodology. With this information, the V&V process can take advantage of the same intelligence used to develop the test program, thereby significantly reducing the learning curve and recurring engineering costs associated with the V&V process. Training courses will also be provided to the users of these software tools.

2.2.2 Provide A Family Of ATLAS Compilers and Translators

The Facility should provide a series of compilers and syntax checkers designed to operate on the ATE and programming stations that are projected for widespread Army use. As a minimum the library must contain a compiler written in RCA EQUATE ATLAS to operate on the USM 410 and a rehostable compiler written in IEEE Std 716 Common ATLAS (the currently approved DOD language for preparing test programs). The rehostable compiler should operate on the AN/USM 410 and the Direct Support/Automatic Test Support System (DS/ATSS) as well as other organizational and direct support ATE that are under current or planned development. The library should also provide access to compilers written in peculiar languages that are being acquired through existing major weapon system contracts. For example, the M-1 tank is acquiring the AN/USM 410, STE/XM-1, Thermal System Test Set (TSTS), Direct Support Electrical System Test Set (DSESTS), etc. ATE to

support the tank at various maintenance levels. Each of these pieces of ATE have different compilers written in different languages that will be used to develop and maintain a large number of test programs.

To save the investment in existing TPS's, the Facility should provide translators that can translate test programs prepared for one set of hardware (ATE) to enable operation on a different station. For example, the Army may find it cost effective to translate programs designed to operate on the USM-410 ATE into programs which will operate on the DS/ATSS ATE or the AN/USM-465.

2.2.3 Provide A Family Of ATLAS Composing Terminals and Programming Stations

The Facility should provide a series of composing terminals and programming stations to aid in the development of test programs. Preparation of efficient test programs requires extensive use of skilled manpower; therefore, the library should provide composing terminals to reduce the time and skills required to prepare test programs. The composing terminals should be capable of preparing test programs in IEEE Std 716 Common ATLAS (C/ATLAS) and RCA EQUATE ATLAS plus other languages that are in widespread Army use on major prime systems.

Much of the initial test program development and debugging may be accomplished through the use of programming stations in lieu of the actual ATE. To reduce the cost of hardware committed to test programs, the Facility should provide a family of programming stations to conduct the initial programming and debug efforts. The final verification and validation will be conducted on the actual ATE, thus the number of ATE stations committed to

2.3.1 Provide TPS Shop Management Aids

The Facility must be able to support functions that aid in matching maintenance shop testing assets (ATE, TPS and technician) to UUT's and available spare parts. It also should aid in the function of scheduling various general support and depot maintenance shops to improve shop productivity and input, thus increasing the number of useable spares available for operational use.

3.0 COMMUNICATION SYSTEM

The key to the success of the library's meeting all the various functional requirements is to assure that all of the documents, aids and tools are readily available to the potential users. Therefore, all the data bases, ATPG's, simulators, etc. should be available to government and contractor users through a real time computerized communication net. Appropriate passwords and control procedures must be established to assure that only authorized and trained agencies and personnel may access the system.

APPENDIX A

ATE SOFTWARE DEVELOPMENT AND SUPPORT FACILITY (LIBRARY)

FUNCTIONS VERSUS CONTENTS

Functions and FRD paragraph numbers	Library contents and concept plan (see App. C) paragraph number
2.1 Support TPS acquisition agencies	
2.1.1 act as focal point for TPS TPS acquisition problems	2.2 (a) Facility Guide and Course
	2.3 (f) TPS Acquisition Data Collection System
	2.3 (m) ATE/TPS operation model
2.1.2 provide means to predict and track cost for TPS development	2.3 (a) TPS Life Cycle Cost Prediction Model
	2.3 (b) TPS Development Cost Models
	2.3 (c) TPS Schedule and Cost Tracking System
2.1.3 provide guidance on preparation of TPS acquisition documents	2.2 (b) TPS Acquisition Guide
	2.2 (c) Design for Testability Guide
	2.2 (d) Test Requirement Document (TRD) Standard
	2.2 (e) Model Unit Under Test TRD SOW
	2.2 (f) Model TPS SOW
	2.2 (g) Model TPS Specifications
	2.2 (h) IEEE ATLAS Standards
	2.2 (i) Other Languages
	2.2 (j) TPS Configuration Management Plan
	2.2 (k) Model TPS ILS Plan

Functions and FRD paragraph numbers	Library contents and concept plan (see App. C) paragraph number
	2.2 (l) Model TPS Quality Assurance Plan
	2.2 (m) Model TPS Request for Proposal (RFP)
	2.3 (h) UUT vs. ATE and ITA matching algorithm
	2.3 (t) Word Processor
	2.3 (m) Workload Analysis System
2.1.4 provide a means to consolidate TPS users' problems for transmission to development agencies	2.3 (d) UUT Failure Data Collection System
	2.3 (e) ATE/TPS Operations Data Collection System
	2.3 (s) Deficiency Reporting and Feedback System
2.1.5 provide Configuration Status Accounting System (CSAS) capabilities	2.3 (p) TPS Developer Configuration Status Accounting System
	2.3 (q) Army TPS Management CSAS
2.2 Support TPS development and maintenance agencies	
2.2.1 provide a family of automatic test program generators and simulators	2.4 (a) Digital ATPG
	2.4 (b) Digital Simulator
	2.4 (c) Analog ATPG
2.2.2 provide a family of ATLAS compilers and translators	2.4 (f) IEEE Std 716 C ATLAS Compiler and Syntax Checker
	2.4 (g) RCA EQUATE ATLAS Compiler and Syntax Checker

Functions and FRD paragraph number	Library contents and concept plan (see App. C) paragraph number
	2.4 (h) Other Compilers and Syntax Checkers
	2.4 (i) Translators
	2.4 (j) FMEA to ATLAS Translator
2.2.3 provide a family of ATLAS composing terminals and programming stations	2.4 (k) ATLAS Composing Terminal
	2.4 (l) Self Learning Test Program Generator
	2.4 (m) Test Program Development Stations
2.2.4 provide a family of programming aids and tools	2.2 (n) TPS Style Guide
	2.3 (g) Library of ATLAS Procedures
	2.3 (i) CAD for ITA
	2.3 (j) Graphics Development Aids
	2.3 (k) TPS Fault Isolation Models
	2.3 (l) TPS Quality Assurance Tools
	2.4 (d) ATLAS Flowchart Generator
	2.4 (e) Text Editor
	2.4 (n) ATE Simulator
2.3 Support GS and depot maintenance shops	
2.3.1 provide TPS shop management aids	2.3 (m) ATE/TPS Operation Model
	2.3 (o) Depot and GS ATE Shop Scheduling System
	2.3 (r) Shop Testing Capabilities System

APPENDIX B

ABBREVIATIONS

AI	Artificial Intelligence
ARCOM	Armament Command
ATE	Automatic Test Equipment
ATLAS	Abbreviated Test Language for All Systems
ATPG	Automatic Test Program (or pattern) Generator
AVCOM	Aviation Command
CAD	Computer Aided Design
C ATLAS	Common Abbreviated Test Language for All Systems
CDRL	Contract Data Requirements List
CECOM	Communications Electronics Command
CM	Configuration Management
CND	Cannot Duplicate
CSA	Configuration Status Accounting
CSAS	Configuration Status Accounting System
CSS	Consolidated Support System
DARCOM	Development and Readiness Command
DBMS	Data Base Management System
DESCOM	Depot System Command
DID	Data Item Description
DS	Direct Support
DS/ATSS	Direct Support/Automatic Test Support System
DSETS	Direct Support Electrical Test Set
ECP	Engineering Change Proposal

FMEA	Failure Modes Effects Analysis
GS	General Support
ID	Interface Device
I/JSATP	Industry/Joint Services Automatic Testing Project
ILS	Integrated Logistic Support
ITA	Interface Test Adapter
JLC	Joint Logistic Commanders
KBS	Knowledge Based System
LCC	Life Cycle Cost
LRU	Line Replacement Unit
MATE	Modular Automatic Test Equipment
MICOM	Missile Command
MIS	Management Information System
NAVELEX	Naval Electronics System Command
NAVSEA	Naval Sea System Command
NSIA	National Security Industrial Association
OPR	Office of Primary Responsibility
PDSS	Post Deployment Software Support
PM-TMDS	Product Manager-Test Measurement and Diagnostic Systems
RFP	Request for Proposal
RTOK	Retest - OK

SOW	Statement of Work
SRU	Shop Replacement Unit
TMDS	Test Measurement and Diagnostic Systems
TOAD	Tobyhanna Army Depot
TP	Test Program
TPI	Test Program Instruction
TPS	Test Program Set
TRA	Test Requirements Analysis
TRD	Test Requirements Document
TSTS	Thermal System Test Set
UUT	Unit Under Test
V&V	Validation and Verification
VAST	Versatile Automated Shop Tester

APPENDIX C

FACILITY CONCEPT DESCRIPTION EXCERPT FROM THE ATE SOFTWARE DEVELOPMENT AND SUPPORT FACILITY CONCEPT PLAN

2.0 FACILITY CONCEPT DESCRIPTION

This section provides a general description of the ATE Software Development and Support Facility and the products available through the library. Details will be provided in the functional requirements document, preliminary design specification, and the implementation plan. The Facility is structured to meet the objectives of providing DARCOM major subordinate commands, program managers, contractors, and maintenance activities with necessary guides, hardware and software required to develop and maintain high quality TPS at a reduced cost. The key to the Facility's meeting the objectives is that the total contents of the library must be readily available to all users in a timely manner. Therefore, the Facility must have responsive communication links as well as documents and training courses to inform users of the content of the library and provide instructions on how to use the various library products.

In many cases the library products are not new or unique; however, many of them are used by only one DARCOM major subordinate command, one program office, one location, or one contractor. What is new is the concept of making all of the items available to all users. The number and location of Facilities will be determined by a workload analysis at a later date.

The following paragraphs present a general discussion of the communication system, standard documentation, programming aids and tools.

2.1 COMMUNICATION SYSTEM

The communication system is critical to the ATE Software Development and Support Facility. Through the communication links all users will be able to access the library and use the various products.

A normal telephone with telecopiers will provide a link for consulting on general matters and will provide timely instructions on accessing the library. Conventional mail and air express shipments can be used to handle large bulk transmittals of data. However, the majority of communication will be provided through a computer hookup with the various users' terminals and mainframes.

The communication computer must have a multi-tasking and multi-programming operating system. It must permit many simultaneous users to rapidly access the various automatic test program generators (ATPG), translators, and data bases.

2.2 STANDARD DOCUMENTATION

The standard documentation required in the Facility are many and varied; in general they will consist of all the documents needed to contract for and to develop high quality, cost effective test program sets. The current status of identified standard documentation is shown in appendix A. To improve the dissemination and currency of the documents, many, if not all, should be available through a data base management system (DBMS) as well as hard copy. The following provides a description of the type of standard documents that are required:

(a) Facility Guide and Training Course - will provide a description of

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(a) Facility Guide and Training Course - will provide a description of

what is contained in the library with instructions on how to access and use the various items.

(b) Test Program Set Acquisition Guide - will provide a "how-to" description of TPS acquisition. The guide should contain flow charts that indicate when the tasks should be completed, who should accomplish the task, and what supporting documentation is available. The guide should be structured to match various acquisition scenarios, such as concurrent with the prime system contract award, after prime system award, and after the prime system is fielded.

(c) Design for Testability Guide - will provide design techniques for use by the weapon system, prime system and automatic test equipment designers to make testing easier, thereby reducing TPS complexity and cost.

d) Test Requirement Document (TRD) Standard - will provide a standard that specifies what type data must be acquired for TPS development, when it is needed, and the format the data must be in.

e) Model Unit Under Test (UUT) Test Requirements Document (TRD) Statement of Work (SOW) - will provide an on-line standard model SOW and appropriate contract data requirements list (CDRL), as well as data item descriptions (DID's) for incorporation into prime system contracts to acquire the unit under test (UUT) TRD data as part of the prime system contract or after the fact. The SOW will

be tailored for specific UUT's through queries and reference to boilerplate contained in the data base.

(f) Model Test Program Set (TPS) Statement of Work (SOW) - will provide an on-line standard model TPS SOW and DID's that can be used to contract for the TPS as part of the prime system contract or as a separate contract. The SOW will be tailored through queries and reference to boilerplate contained in the data base.

(g) Model Test Program Set (TPS) Specifications - will provide on-line model system and performance specifications that can be tailored to define the TPS requirements through user queries.

(h) ATLAS Standard - will provide copies of IEEE Std 716-1982 Common ATLAS which is the DOD directed standard language for preparing test programs.

(i) Other Languages - will provide copies of manuals covering languages in widespread Army use, such as EQUATE ATLAS.

(j) Test Program Set (TPS) Configuration Management (CM) Plans - will provide on-line model TPS CM plans that can be easily tailored and included in various TPS acquisition contracts; Army depots that will be maintaining the TPS may also use a standard TPS CM plan.

(k) Model TPS Integrated Logistic Support (ILS) Plan - will provide an on-line computer program that through user query and reference to boilerplate will generate a tailored TPS ILS plan.

(l) Model TPS Quality Assurance Plan - will provide an on-line computer program that will generate a tailored TPS quality assurance plan through user query and reference to boilerplate.

(m) Model TPS Request For Proposal (RFP) - will provide an on-line computer program which embodies Army policy with respect to TPS procurement. A TPS Development RFP can be developed through user query and reference to boilerplate.

(n) TPS Style Guide - will provide a Test Program Style Guide outlining common format, flow charts, etc., to aid in reducing the diverse means of documenting TPS. A common style should reduce the time and cost to maintain future TPS.

2.3 Programming Aids

Programming Aids are defined as a group of data base systems that provide information to be used in developing test program sets. Included also are data bases that are part of a repairable management system. All of the data bases will be accessable through remote terminals. If required, special access codes can be used to restrict contractor use of data bases that contain proprietary data provided by other companies. The current status of identified programming aids is shown in Appendix A.

computer aided system for collecting, organizing and saving data about ATE and TPS usage, effectiveness and support cost.

(f) TPS Acquisition Data Collection System - will provide a computer aided system for collecting, allocating and storing data about manpower, material and costs of TPS development. Included also will be Army cost for preparing request-for-proposals (RFP's), conducting source selection, contract award and contract monitoring.

(g) Library of ATLAS Procedures - will provide a library of ATLAS procedures to be used in developing a TPS. The procedures will aid in standardizing the resulting TPS and simplifying the coding process.

(h) Unit Under Test (UUT) versus Automatic Test Equipment (ATE) and Interface Test Adapter (ITA) Matching Algorithm - will provide a computer data base system that will aid in matching new UUT testing requirements with existing ATE and ITA.

(i) Computer Aided Design (CAD) for Interface Test Adapters (ITA's) - will provide an on-line CAD system that will support the design of ITA's.

(j) Graphics Development Aids - will provide a computer aided system to assist in development of software that will provide a detailed display of the testing flow to the ATE operator.

(k) TPS Fault Isolation Models - will provide a computer system to aid in predicting the fault isolation potential for TPS's to be

The following provides a description of the type of programming aids that are required:

(a) TPS Life Cycle Cost (LCC) Prediction Model - will provide mathematical models for estimating total cost of developing and maintaining TPS's over the life of a weapon or prime system.

(b) TPS Development Cost Models - will provide mathematical models to estimate cost of developing TPS's during the conceptual and validation phases of weapon and prime system development.

(c) TPS Schedule and Cost Tracking System - will provide a system that can easily track current performance and cost against predicted cost. The system will also provide feedback to update the cost prediction models.

(d) Unit Under Test (UUT) Failure Data Collection System - will provide a computer aided system for collecting, organizing and storing data on type and frequency of UUT failures. The system should also track and provide an analysis of retest - OK (RTOK) and cannot duplicate (CND) actions. The total analysis should be automatically completed by grouping common classes of faults as well as faults identified against a specific serial numbered shop replacement unit (SRU) or line replacement unit (LRU). The data gathering aspect of this can be automated as part of the ATE operating system.

(e) ATE/TPS Operations Data Collection System - will provide a

used in developing test specifications.

(l) TPS Quality Assurance - will provide computer quality assurance systems to aid in developing, validating and verifying (V&V) TPS. The models should permit assessment at several different points in the development process. The first assessment shall be conducted prior to coding the test program.

(m) Workload Analysis System - will provide as part of a repairable management system an on-line data system that consists of classification and distribution profiles of repairables and matches these profiles to the available maintenance assessment required to test and repair the failed UUT.

(n) ATE/TPS Operation Model - will provide as part of a repairable management system a model for estimating the ATE Software Development and Support Facility workload, turnaround time, etc.

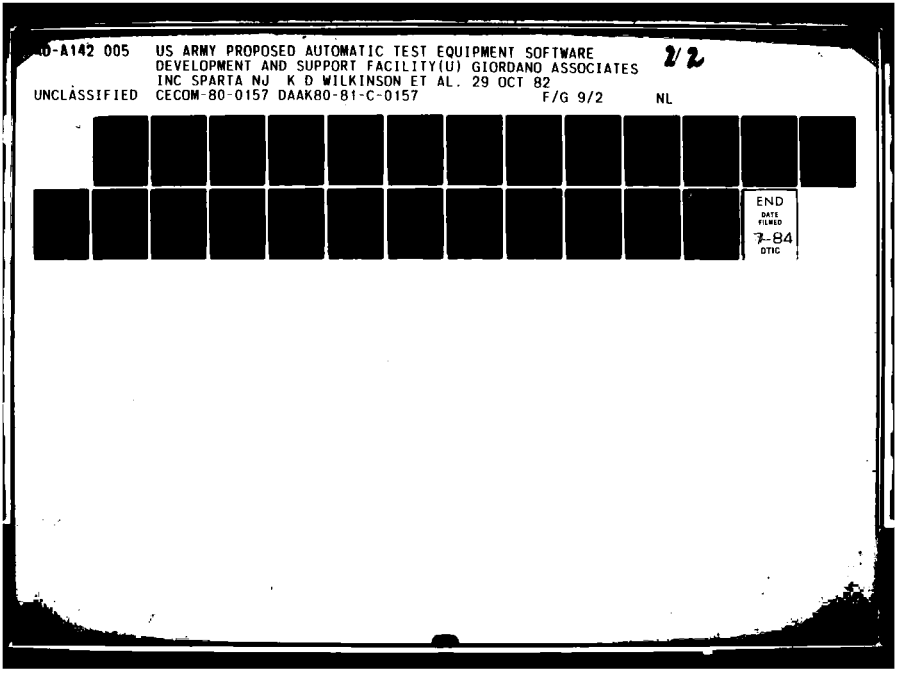
(o) Depot and General Support (GS) ATE Shop Scheduling System - will provide as part of a repairable management system an on-line computer program that will accept user specified constraints and then provide a repair schedule that guarantees optimum shop throughput.

(p) TPS Developer Configuration Status Accounting System (CSAS) - will provide an on-line computer program and a set of procedures that will permit the Army or contractor TPS developer to keep track of the UUT, ATE and TPS configuration during the TPS development phase.

(q) Army TPS Management Configuration Status Accounting System (CSAS) - will provide an on-line computer program and a set of procedures that will permit the Army organizations responsible for tracking and maintaining the TPS to keep track of the UUT, ATE and TPS configuration after deployment. The Army TPS management CSAS will not track some of the milestones included in the developer CSAS such as interim changes during quality assurance and validation and verification checks; however, it will contain additional information such as TPS physical location and status of engineering change proposals (ECP's) that affect the TPS.

(r) Shop Testing Capabilities System - will provide as part of a repairable management system an on-line data system that will display an assessment of the shop testing capabilities. The assessment will indicate what UUT's can be tested with the assigned ATE and TPS based on the current configuration of ATE, TPS and UUT. It also will provide an assessment based on degraded ATE's or ITA's capabilities due to failures. The data base can be established to obtain automatic updates from the command configuration status accounting system.

(s) Deficiency Reporting and Feedback System - will permit a rapid transmission of TPS deficiencies to a central organization. The system should also provide for a rapid feedback on workaround procedures and the schedule for deficiency correction.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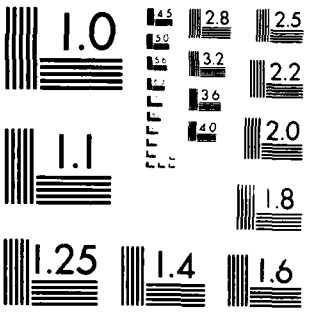

(t) Word Processor - provides a word processor computer program for preparing and updating the test proposal instructions (TPI's). The word processor will also be available to update the various standard documentation included within the Facility.

2.4 Programming Tools

Programming tools are defined as a group of computer based systems that are used directly by the programmers to develop test programs. There are many existing tools that perform similar functions; therefore, one of the major tasks in this area will be to identify a specific tool or a family of related tools for inclusion in the Facility. The following provides a description of the programming tools that are required:

(a) Digital Automatic Test Pattern Generator (ATPG) - provides a family of computer programs that will analyze a digital circuit description of a UUT and generate a test program for that UUT.

(b) Digital Simulator - provides a family of computer programs that will evaluate the fault detection effectiveness of a digital test. The program should also generate test responses and fault isolation data.

(c) Analog Automatic Test Program Generator (ATPG) - provides a computer program that will analyze an analog circuit description and generate a test program for that UUT.

(d) ATLAS Flowchart Generator - provides a computer program for analyzing a test program written in ATLAS and automatically generates a pictorial and commented flowchart of the program.

(e) Text Editor - provides an on-line computer program for viewing and modifying computer programs.

(f) IEEE Std 716, Common ATLAS Compiler and Syntax Checker - provides a portable IEEE Std 716 ATLAS Compiler that will check the syntax of ATLAS programs, provide appropriate warning and error messages, and translate the 716 ATLAS code into an intermediate code or into a format suitable for execution on a specific test station.

(g) EQUATE ATLAS Compiler and Syntax Checker - provides an EQUATE ATLAS Compiler that will check the syntax of EQUATE test programs, provide appropriate warning and error messages, and translate the EQUATE ATLAS into a format suitable for execution on a AN/USM 410.

(h) Other compilers and syntax checkers - provide the additional compilers and syntax checkers that are required to support the assigned TPS.

(i) Translators - provide a family of translators capable of translating test programs written on one tester to operate on another tester or from one language to another. For example, AN/USM 410 ATE to GENRAD 2225 ATE, Chrysler DSETS Language to IEEE Std 716 Common ATLAS, EQUATE ATLAS Language to IEEE Std 716 Common ATLAS, IEEE Std 716 Common ATLAS to EQUATE ATLAS, etc.

(j) Failure Modes Effects Analysis (FMEA) to ATLAS Translator - provides an on-line computer program that will translate the FMEA

failure signatures directly into the diagnostic portion of an IEEE Std 716 Common ATLAS test program.

(k) ATLAS Composing Terminal - provides an on-line computer program that through templates or some other means lead a technician through the process of developing IEEE Std 716 ATLAS test programs. The system should accept test requirement document (TRD) data and develop a test program as well as accept detailed source data and generate both a TRD and a test program.

(l) Self Learning TP Generator - provides a self learning test program generator using knowledge based system (KBS) and artificial intelligence (AI) technology. The self learning generator will be able to automatically improve the test program based on actual testing data.

(m) Test Program Development Stations - provide the necessary test program development stations, including EQUATE ATLAS and Common ATLAS Compilers, to permit initial development of test programs without using the complete ATE stations.

(n) ATE Simulator - will be provided to conduct off-line testing for logic and parameter errors during execution of ATLAS programs.

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US ARMY

PROPOSED

AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

PRELIMINARY DESIGN SPECIFICATION

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This preliminary design specification describes a system for supporting all fife cycle actibities of functional and diagnostic test programs used with Automatic Test Equipment. It specifies all the hardware, software, and documentation tools required for test program acquisition, development, maintenance, and management and indicates their interrelationships.		

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Preliminary Design Specification

For

AN ATE SOFTWARE DEVELOPMENT & SUPPORT FACILITY

April 15,1982

TABLE OF CONTENTS

1.0 SCOPE

1.1 Purpose

This preliminary design specification describes the hardware, software, and documents to be installed in one or more Army facility to provide support for the development, maintenance, and management of functional and diagnostic test programs used with Automatic Test Equipment (ATE).

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents

The following documents of current issue form a part of this specification to the extent specified herein.

2.2 Non-Government Documents

The following documents of current issue form a part of this specification to the extent specified herein.

IEEE Standard 716, Common ATLAS

3.0 REQUIREMENTS

3.1 System Definition

The system shall consist of an aggregate of hardware, software, and documentation which shall support the acquisition, development management and maintenance of Test Program Sets (TPS) within the Army. The system may be implemented as a single facility or as multiple facilities depending on the location and workloads to be supported.

3.1.1 General definition

The system shall consist of a communication subsystem, an acquisition support subsystem, an operational support subsytem, and a TPS development and maintenance support subsystem. The communication subsystem shall permit the support subsystems to be utilized by remote users. Each of the support subsystems shall consist of one or more computer system, software packages, and documentation.

3.1.2 Missions

The system shall support the following missions:

- o Act as focal point for TPS acquisition problems
- o Provide a means to predict and track cost for TPS development and operation
- o Provide guidance in preparation of TPS acquisition documents
- o Provide a means to consolidate TPS users' problems for transmission to development agencies
- o Provide Configuration Status Accounting (CSAS) capabilities
- o Provide a family of automatic test program generators and simulators
- o Provide a family of ATLAS compilers and translators
- o Provide a family of ATLAS composing terminals and programming stations
- o Provide a family of programming aids and tools
- o Provide TPS shop management aids

3.1.3 System diagram

The overall system consists of the following hardware items:

- o Communications network
- o Acquisition and management computer system
- o Digital ATPG development and maintenance computer system
- o Analog test development and maintenance computer system

The interconnections between these items are shown in figure 3-1. Within each of these hardware items are software packages and documentation particularly applicable to the functions provided by the computer systems. Figures 3-2, 3-3, and 3-4 show these packages and the data interconnections between them for each of the computer systems.

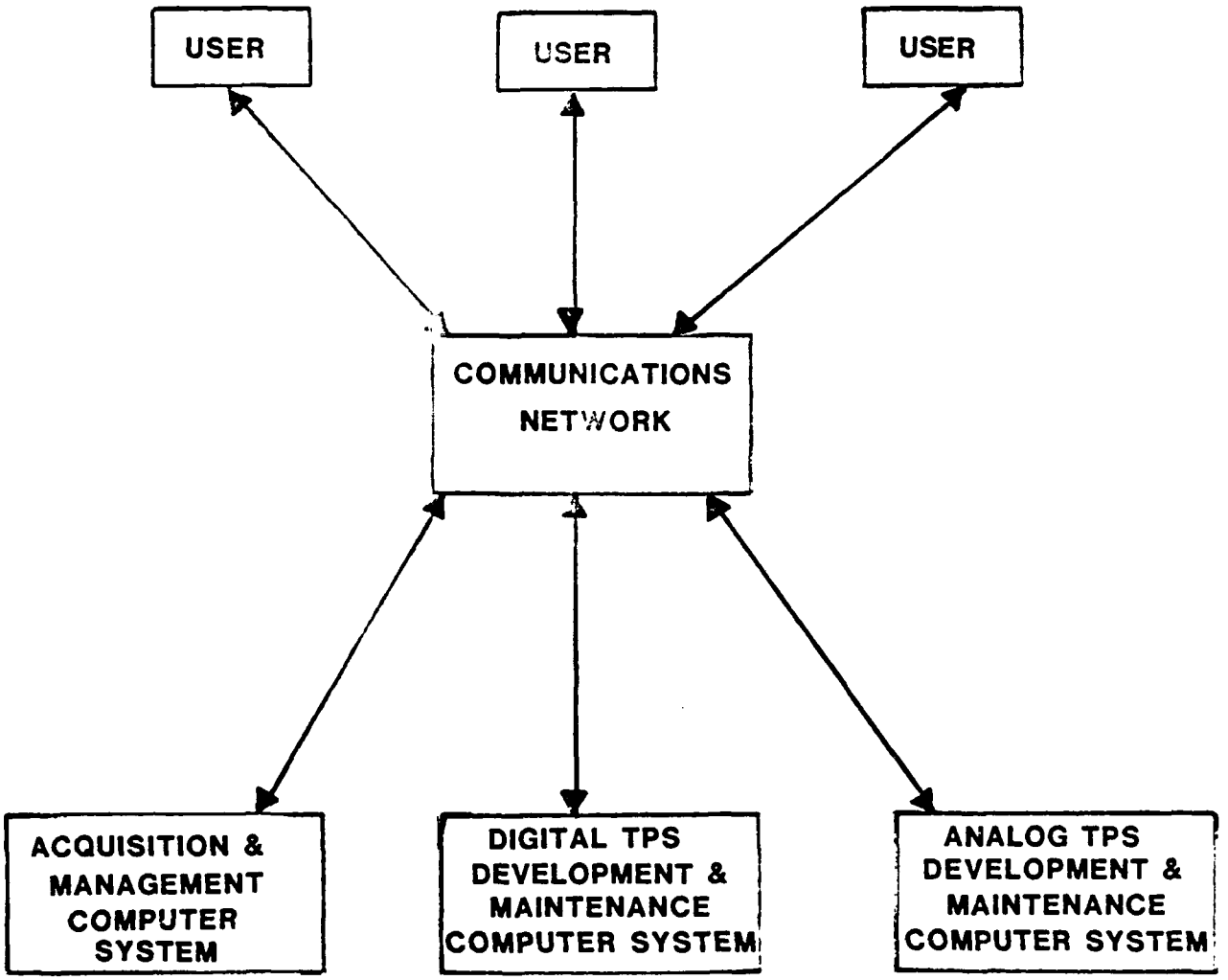


FIGURE 3-1 SYSTEM DIAGRAM

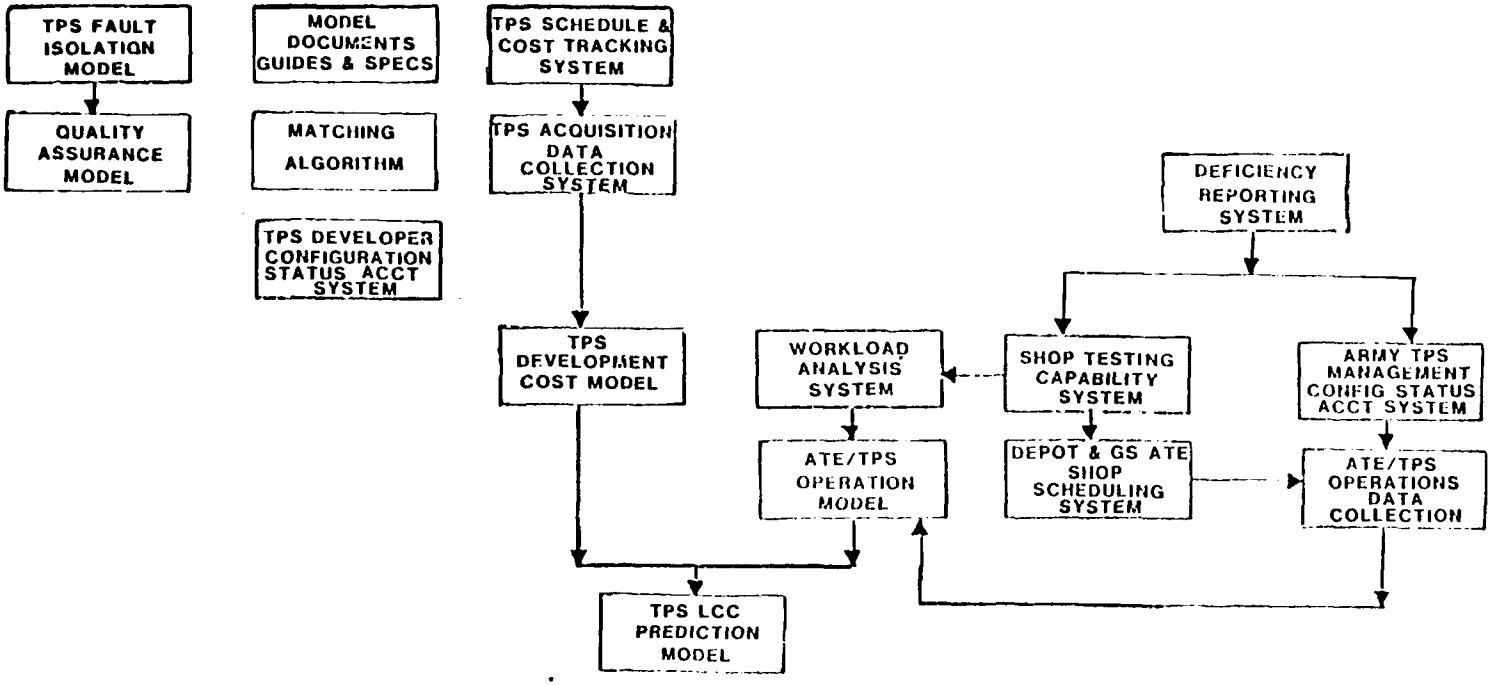
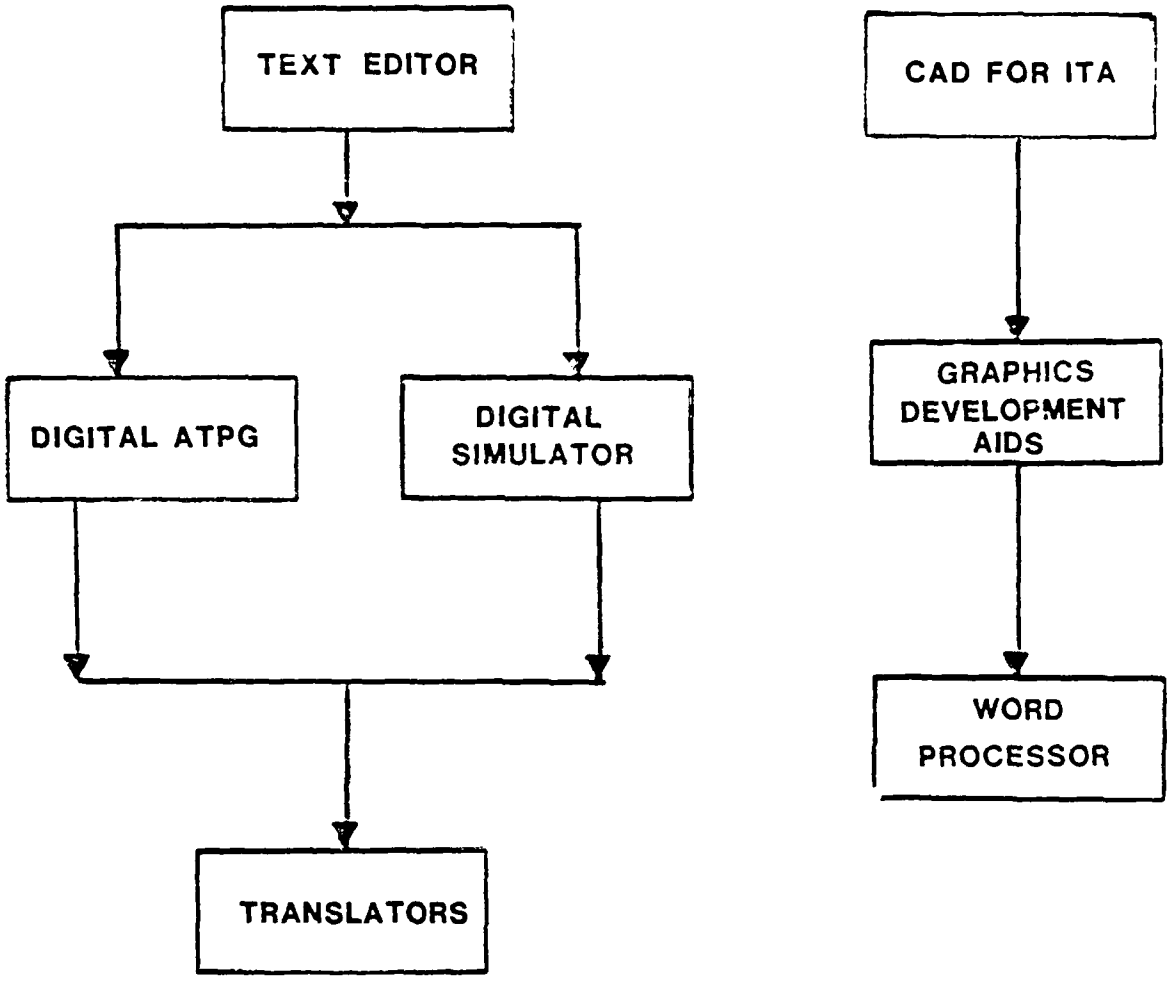


FIGURE 3-2 ACQUISITION & MANAGEMENT SOFTWARE SYSTEM



TEST PROGRAM SET DEVELOPMENT STATION

FIGURE 3-3

DIGITAL TPS SUPPORT SOFTWARE SYSTEM

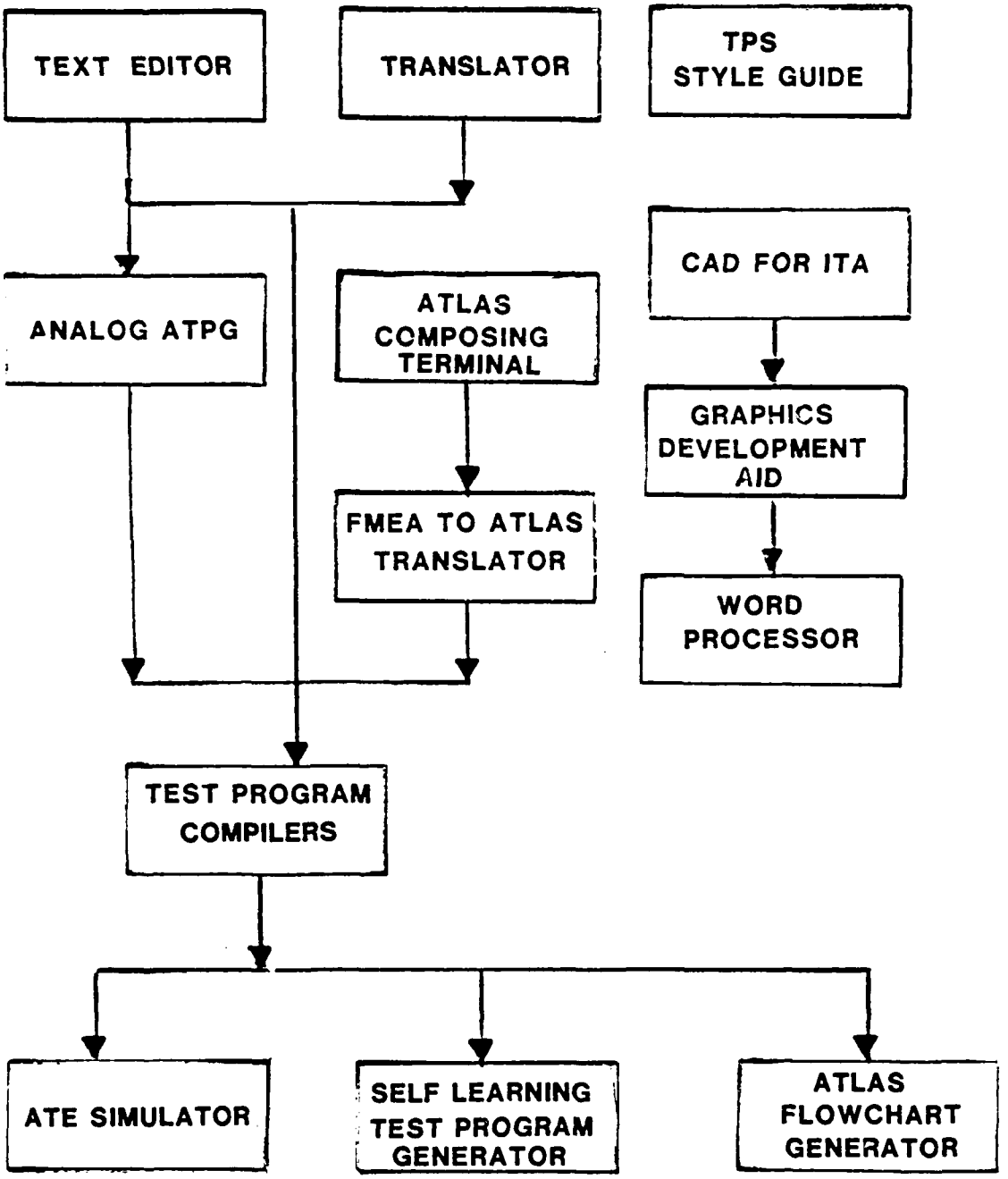


FIGURE 3-4
ANALOG TPS SUPPORT SOFTWARE SYSTEM

3.1.4 Interface definitions

There are three types of interfaces provided by the system as follows:

- o Interaction with users through keyboards and CRT terminals
- o Printed reports generated by the system
- o Communication of data to ATE and other computers using magnetic media or communications lines

The interfaces of each functional software package or part thereof are shown in Table 3-1. The interfaces between the software packages are illustrated in Figures 3-2, and 3-3.

TABLE 3-1 SYSTEM EXTERNAL INTERFACES

Function	Software Package	--- Interface Mode --- CRT	Print	ATE
1	Facility Guide and Course	--	YES	--
	TPS Acquisition Data Collection System	YES	YES	YES
2	TPS LCC Prediction Model	YES	YES	--
	TPS Development Cost Model	YES	YES	--
	TPS Schedule & Cost Tracking System	YES	YES	--
3	TPS Acquisition Guide	--	YES	--
	Design for Testability Guide	--	YES	--
	TRD Standard	--	YES	--
	Model SOW for UUT TRD	--	YES	--
	Model SOW for TPS	--	YES	--
	Model TPS Specifications	--	YES	--
	IEEE ATLAS Standards	--	YES	--
	Army Fielded Test Languages	--	YES	--
	Model TPS CM Plan	--	YES	--
	Model TPS ILS Plan	--	YES	--
	Model TPS QA Plan	--	YES	--
	Model TPS RFP	--	YES	--
	TPS Fault Isolation Model	YES	YES	--
	TPS QA Model	YES	YES	--
	Matching Algorithms	YES	YES	--
	Workload Analysis System	YES	YES	--
	Word Processor	YES	YES	--

4	UUT Failure Data Collection System	YES	YES	YES
	ATE/TPS Operations Data Collection System	YES	YES	YES
	Deficiency Reporting & Feedback System	YES	YES	--
5	TPS Developer CSAS	YES	YES	--
	Army TPS Management CSAS	YES	YES	--
6	Digital ATPG	YES	YES	YES
	Digital Simulator	YES	YES	YES
	Analog ATPG	YES	YES	YES
7	IEEE C/ATLAS Compiler & Syntax Checker	YES	YES	YES
	EQUATE ATLAS Compiler & Syntax Checker	YES	YES	YES
	Fielded Test language Compilers & Syntax Checkers	YES	YES	YES
	Translators	YES	YES	YES
	FMEA to ATLAS Translator	YES	YES	YES
8	ATLAS Composing terminal	YES	YES	--
	Self Learning Test Program Generator	YES	YES	YES
	Test Program Development Stations	YES	YES	YES
9	TPS Style Guide	--	YES	--
	CAD for ITA	YES	YES	--
	Graphics developments Aids	YES	YES	--
	TPS Fault Isolation Models	YES	YES	--
	TPS Quality Assurance Tools	YES	YES	--
	ATLAS Flowchart Generator	--	YES	--
	Text Editor	YES	--	--
	ATE Simulator	YES	YES	--
	Self Learning Test Program Generator	YES	YES	YES
10	ATE/TPS Operation Model	YES	YES	--
	Depot & GS Shop Scheduling System	YES	YES	YES
	Shop Testing Capabilities System	YES	YES	YES

3.2 Performance Characteristics

The system shall support each of the missions described in paragraph 3.1.2 by timely responses to terminal key entries, generating reports requested in a timely manner, and generating periodically those reports required on a periodic basis. The responses and reports shall meet the requirements of the missions as described below.

3.2.1 Focal Point for TPS Acquisition Problems

The system shall provide interfaces for the collection of data about TPS acquisition events, the data base system required to support that data, and the capability to respond to queries on that data and generate reports describing that data. It shall provide the means of collecting the data from computer files maintained by the TPS Schedule and Cost Tracking system, telephone calls, conferences, written correspondance, and technical reports. The system shall provide detailed and summary reports of any TPS acquisition experience gathered by cost, schedule, acquisition strategy, UUT technology, ATE type, complexity, or other factors which may be useful in planning or implementing a new TPS acquisition. It shall have available all standards applicable to acquisition of TPSs, and a description of the current aids and tools which may be used in TPS acquisition and development. The full capability and operation of the system shall be documented in a Facility Guide, and be available in the form of a training course.

3.2.2 Prediction And Cost Tracking Of TPS Development

The system shall accept data concerning proposed TPS development factors and, by using a TPS Development Cost Model, shall predict the cost of developing the TPSs and minimum development time. It shall also accept data concerning the proposed utilization of the TPSs, either from the data files of the ATE/TPS Operation Model or from manual entries, and predict the Life Cycle Cost of acquiring and operating the TPSs. The system cost models shall be periodically updated based on the data available from the data collection system. Access to these models shall be provided directly to acquisition managers or other users through a remote CRT terminal or remote job entry terminals. The system shall also provide support for the tracking of TPS development schedules and costs. This support shall include data entry screens for ease of entry of schedule and cost plans, critcal path method analyses of these plans, reports of the plans and analyses, data entry and query screens for the entry of current TPS development schedule and cost statuses, and reports on these statuses.

3.2.3 Preparation of TPS Acquisition Documents

The system shall maintain and provide copies as requested of TPS related guides, standards, and model documents including at least the following:

- o TPS Acquisition Guide
- o Design For Testability Guide
- o Test Requirement Document (TRD) Standard
- o ATLAS Language Standard
- o Model Statement of Work for Test Requirement Documents
- o Model Test Program Set Specifications
- o Model TPS Configuration Management Plan for development projects
- o Model TPS Integrated Logistics Support Plan
- o Model TPS Quality Assurance Plan
- o Model Request for Proposal for acquiring TPSs

These documents shall be supplemented by computer aids. Among the aids shall be word processing capability which, in conjunction with the model documents, provides a "fill in the blanks" capability for developing acquisition documents. The system shall provide support for the determination of the number of TPSs to order, and which versions of the ATE for which they are to be provided. This support will be provided in the form of a Work Load Analysis System, a matching algorithm between UUT and existing ITAs, and an ATE/TPS Operation Model of the existing testing system. These systems shall accept data from the Shop Testing Capability System files, the ATE/TPS Operations Data Collection Systems and user manual entry. Based on this data, they will predict the number of TPSs of each UUT required and relevant characteristics required to make the most effective use of current capabilities. Access to these models shall be provided directly to acquisition managers or other users through a remote CRT terminal or remote job entry terminal.

3.2.4 Consolidation of TPS Problems

The system shall provide the means of accepting deficiency report data either through a remote terminal or through transmitted documents. The system shall validate the data against the deployed ATE and TPS configuration items, determine the individuals responsible for their corrections, distribute the deficiency reports, provide reports classifying them and grouping them, and provide tracking services through their resolution. In addition to collecting data on deficiency reports, the system shall

collect data on the operation of the deployed ATE and TPSs. It shall include the means of collecting ATE data log information and processing it to determine utilization of each deployed ATE and TPS, availability history of ATE, and number and type of failures of tested UUT found. This data along with summary data about deficiency reports shall be provided in monthly reports by the system.

3.2.5 ATE And TPS Configuration Status Accounting

The system shall provide support for configuration status accounting of operational ATE and TPS in the following areas:

- o On-line support for the data entry, data base query, and data base update of identification and description of ATE and TPS configuration items
- o The generation of configuration status accounting reports and other reports required to support TPS development and maintenance decisions
- o On-line support and the generation of appropriate reports for the tracking of engineering changes to ATE and TPSs
- o On-line support and the generation of appropriate reports for the tracking of deployment of physical configuration items within the Army (including shipments)

In addition to providing support for operational ATE and TPS, the system shall provide a similar capability for those responsible for the development of a set of TPSs.

3.2.6 Automatic Test Program Generators and Simulators

The system shall provide digital test program engineers with on-line terminal access to state-of-the-art digital simulators and digital test program generators. These tools shall automatically or semi-automatically generate digital functional tests, and data for fault signature and guided probe diagnostics. They shall also provide a measure of the portion of failures which will be detected by the test and the size distribution of the ambiguity groups identified through the fault signature failure isolation data. The access to system shall also provide state-of-the-art analog simulation and test generation software. It shall provide reference manuals and courses for those not familiar with any of these tools operations.

3.2.7 ATLAS Compilers And Translators

The system shall provide test program engineers charged with the preparation and maintenance of Army test programs with off-ATE compilers for the common languages used on Army test stations. The compiler output which are generated shall be suitable for execution on the appropriate ATE. The system shall also make available any translators developed for converting the source language of one ATE into that of another ATE or for transforming the output of one compiler into a format suitable for execution on an ATE different from its original target. These compilers and translators shall be available to the user through a terminal at his location. The system shall have the capability of transferring the data to the target ATEs via the appropriate media (magnetic tape, cassette, PROMs, or communication lines).

3.2.8 Composing Terminals And Programming Stations

The system shall provide an integrated set of software packages which support the development of test requirement documents, test programs, and test instructions. These packages shall include templates and formatted screens for the original data entry, translation packages to reformat the data for each of the three items, and compilers and word processors for preparation of the data for final use.

3.2.9 Programming Aids And Tools

The system shall provide a set of tools for a test program engineer to assure that the whole test program is of high quality as follows:

- Test program design architecture and details are addressed through a TPS Style Guide and a library of standard ATLAS procedures.
- Test performance and ATE compatibility is addressed through TPS fault isolation models, a set of TPS Quality Assurance Software Packages, and an ATE Simulator.
- Interface adapter design is addressed through a computer aided design package.
- Documentation quality is addressed with graphics developments aids, flow chart generators, word processors, and text editors

3.2.10 ATE/TPS Shop Management Aids

The system shall on-line terminal entry, update and query capability to Depot and GS shop managers for optimum utilization of his testing capabilities within priority constraints. He shall be able to update the data base of shop capabilities to show new resources obtained, resources lost, or resources which are temporarily unavailable or degraded due to failures. He shall be able to enter new items requiring testing as they enter and indicate items removed through testing or other means and changes in priority as provided. The system will furnish him an optimal schedule and with stock room packing list requirements. It shall identify items not testable with the current capability and will make allowance for limited quantities of ATE, interface test adapters, and test program media.

3.3 Design And Construction

The system shall be designed and constructed of commercially available and field proven hardware and software wherever that is available.

3.4 Documentation

All hardware and software shall include a complete set of documentation suitable for training and reference in its operation and maintenance.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General

Each functional component of the system and the overall system performance shall be evaluated with formal tests/verifications of performance, design characteristics, and operability. The following types of tests and verifications shall be applied:

- o Reliability Testing - The collection, recording, and analysis of data concerning time between system failures
- o Design Engineering Evaluation - The analysis of design and test documents as they are developed
- o Qualification Testing - The carrying out of test procedures on configuration items and critical items to qualify them for inclusion in the system
- o Installation Testing And Checkout - Tests which assure that the delivered and installed configuration and critical items are operational including: continuity checking, interface mating, operability within system environment,

support equipment compatibility, and proper documentation

- o Formal Test - Verification that the item and system meets all requirements and performance characteristics specified

Wherever commercial items used, testing for that item shall be restricted to qualification testing and installation testing and checkout. Design engineering evaluation and formal test shall be used to assure that specially designed components and the overall system meet their specified requirements.

4.2 Quality Conformance Inspections

The nature of the quality assurance inspections for each functional system item is contained in Table 4-1. These inspections shall be implemented in an order such that installation tests and checking and formal test are accomplished at the location of the facilities.

TABLE 4-1 QUALITY CONFORMANCE INSPECTION REQUIREMENTS

Area	Configuration Item	Reliability	Eng. Eval	Qualific at'n	Installation	Formal Test
1.1	ATE Support Facility	YES	YES	--	YES	YES
1.2	Communications Network	YES	--	--	YES	YES
1.3	Acq. & Mangement Computer	YES	--	YES	YES	--
1.4	Digital Test Dev't Computer	YES	--	YES	YES	--
1.5	Analog Test Dev't Computer	YES	--	YES	YES	--
2.1	Facility Guide and Course	--	YES	--	--	YES
	TPS Acquisition Data Collection System	YES	YES	--	YES	YES
2.2	TPS LCC Prediction Model	--	YES	--	YES	YES
	TPS Development Cost Model	--	YES	--	YES	YES
	TPS Schedule & Cost Track'g System	--	YES	--	YES	YES

2.3	TPS Acquisition Guide	--	YES	--	--	--
	Design for Testability Guide	--	YES	--	--	--
	TRD Standard	--	YES	--	--	--
	Model SOW for UUT TRD	--	YES	--	--	--
	Model SOW for TPS	--	YES	--	--	--
	Model TPS Specifications	--	YES	--	--	--
	IEEE ATLAS Standards	--	YES	--	--	--
	Army Fielded Test Languages	--	YES	--	--	--
	Model TPS CM Plan	--	YES	--	--	--
	Model TPS ILS Plan	--	YES	--	--	--
	Model TPS QA Plan	--	YES	--	--	--
	Model TPS RFP	--	YES	--	--	--
	TPS Fault Isolation Model	--	YES	--	YES	YES
	TPS QA Model	--	YES	--	YES	YES
	Matching Algorithms	--	YES	--	YES	YES
	Workload Analysis System	YES	YES	--	YES	YES
	Word Processor	--	--	YES	YES	--
2.4	UUT Failure Data Collection System	YES	YES	--	YES	YES
	ATE/TPS Operations Data Collection System	YES	YES	--	YES	YES
	Deficiency Reporting & Feedback System	YES	YES	--	YES	YES
2.5	TPS Developer CSAS	--	YES	--	YES	YES
	Army TPS Management CSAS	YES	YES	--	YES	YES
2.6	Digital ATPG	--	--	YES	YES	--
	Digital Simulator	--	--	YES	YES	--
	Analog ATPG	--	--	YES	YES	--
2.7	IEEE C/ATLAS Compiler & Syntax Checker	--	--	YES	YES	--
	EQUATE ATLAS Compiler & Syntax Checker	--	--	YES	YES	--
	Fielded Test language Compilers & Syntax Checkers	--	YES	--	YES	YES
	Translators	--	YES	--	YES	YES
	FMEA to ATLAS Translator	--	YES	--	YES	YES
2.8	ATLAS Composing terminal	--	YES	--	YES	YES
	Self Learning Test Program Generator	--	YES	--	YES	YES
	Test Program Development Stations	--	YES	--	YES	YES

2.9	TPS Style Guide	--	YES	--	--	--
	CAD for ITA	--	--	YES	YES	--
	Graphics developments Aids	--	--	YES	YES	--
	TPS Fault Isolation Models	--	YES	--	YES	YES
	TPS Quality Assurance Tools	--	YES	--	YES	YES
	ATLAS Flowchart Generator	--	YES	--	YES	YES
	Text Editor	--	--	YES	YES	--
	ATE Simulator	--	YES	--	YES	YES
	Self Learning Test Program Generator	--	YES	--	YES	YES
2.10	ATE/TPS Operation Model	--	YES	--	YES	YES
	Depot & GS Shop Scheduling System	--	YES	--	YES	YES
	Shop Testing Capabilities System	--	YES	--	YES	YES

RESEARCH AND DEVELOPMENT TECHNICAL REPORT

CECOM-80-0157

US ARMY PROPOSED AUTOMATIC TEST EQUIPMENT SOFTWARE DEVELOPMENT AND SUPPORT FACILITY

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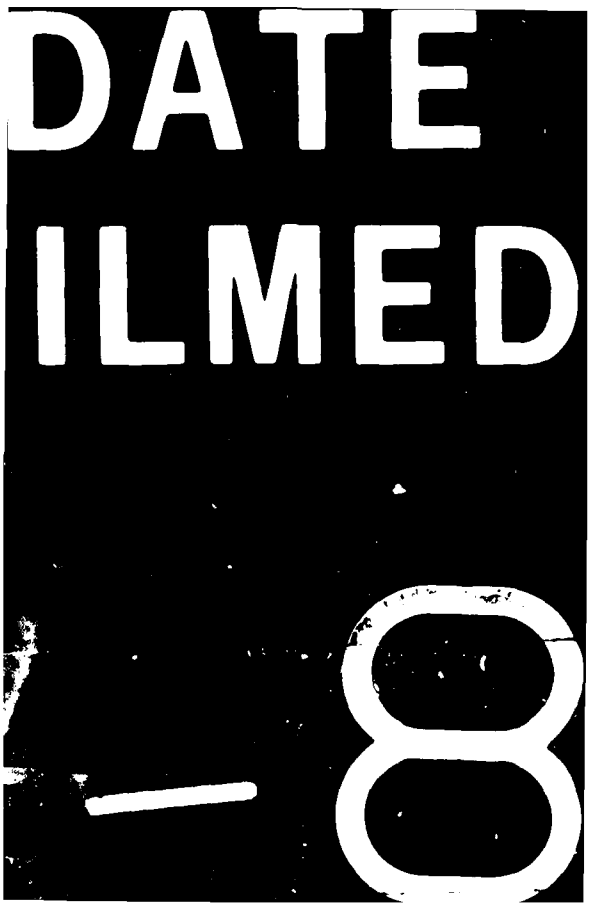
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